Optima CL320i, CL323i, IGS 320 Cardiovascular Imaging System

Conformance Statement of DICOM

OPERATING DOCUMENTATION

5490857-1-8EN
Revision 1

ATTENTION

LES APPAREILS A RAYONS X SONT DANGEREUX A LA FOIS POUR LE PATIENT ET POUR LE MANIPULATEUR SI LES MESURES DE PROTECTION NE SONT PAS STRICTEMENT APPLIQUEES

Bien que cet appareil soit construit selon les normes de sécurité les plus sévères, la source de rayonnement X représente un danger lorsque le manipulateur est non qualifié ou non averti.
Une exposition excessive au rayonnement X entraîne des dommages à l'organisme.
Par conséquent, toutes les précautions doivent être prises pour éviter que les personnes non autorisées ou non qualifiées utilisent cet appareil créant ainsi un danger pour les autres et pour elles-mêmes.
Avant chaque manipulation, les personnes qualifiées et autorisées à se servir de cet appareil doivent se renseigner sur les mesures de protection établies par la Commission Internationale de la Protection Radiologique, Annales 26 : Recommandations de la Commission Internationale sur la Protection Radiologique et les normes nationales en vigueur.

WARNING

X-RAY EQUIPMENT IS DANGEROUS TO BOTH PATIENT AND OPERATOR UNLESS MEASURES OF PROTECTION ARE STRICTLY OBSERVED

Though this equipment is built to the highest standards of electrical and mechanical safety, the useful x-ray beam becomes a source of danger in the hands of the unauthorized or unqualified operator.
Excessive exposure to x-radiation causes damage to human tissue.
Therefore, adequate precautions must be taken to prevent unauthorized or unqualified persons from operating this equipment or exposing themselves or others to its radiation.
Before operation, persons qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 26 of the ICRP, and with applicable national standards.

ATENCION

LOS APARATOS DE RAYOS X SON PELIGROSOS PARA EL PACIENTE Y EL MANIPULADOR CUANDO LAS NORMAS DE PROTECCION NO ESTAN OBSERVADAS

Aunque este aparato está construido según las normas de seguridad más estrictas, la radiación X constituye un peligro al ser manipulado por personas no autorizadas o incompetentes. Una exposición excesiva a la radiación X puede causar daños al organismo.
Por consiguiente, se deberán tomar todas las precauciones necesarias para evitar que las personas incompetentes o no autorizadas utilicen este aparato, lo que sería un peligro para los demás y para sí mismas.
Antes de efectuar las manipulaciones, las personas habilitadas y competentes en el uso de este aparato, deberán informarse sobre las normas de protección fijadas por la Comisión Internacional de la Protección Radiológica, Anales No 26: Recomendaciónes de la Comisión Internacional sobre la Protección Radiológica y normas nacionales.

ACHTUNG

RÖNTGENAPPARATE SIND EINE GEFAHR FÜR PATIENTEN SOWIE BEDIENUNGSPERSONAL, WENN DIE GELTENDEN SICHERHEITSVORKEHRUNGEN NICHT GENAU BEACHTET WERDEN

Dieser Apparat entspricht in seiner Bauweise strengsten elektrischen und mechanischen Sichereitsnormen, doch in den Händen unbefugter oder unqualifizierter Personen wird er zu einer Gefahrenquelle.
Übermäßige Röntgenbestrahlung ist für den menschlichen Organismus schädlich.
Deswegen sind hinreichende Vorsichtsmaßnahmen erforderlich, um zu verhindern, daßunbefugte oder unqualifizierte Personen solche Geräte bedienen oder sich selbst und andere Personen deren Bestrahlung aussetzen können.
Vor Inbetriebnahme dieses Apparats sollte sich das qualifizierte und befugte Bedienungspersonal mit den geltenden Kriterien für den gefahrlosen Strahleneinsatz durch sorgfältiges Studium des Hefts Nr. 26 der Internationalen Kommission für Strahlenschutz (ICRP) vertraut machen: Empfehlungen der Internationalen Kommission für Strahlenschutz und anderer nationaler Normenbehörden.

Important Information

LANGUAGE

ПРЕДУПРЕЖДЕНИЕ (BG)

Това упътване за работа е налично само на английски език.

- Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод.
- Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа.
- Неспазването на това предупреждение може да доведе до нараняване на доставчика на услугата, оператора или пациента в резултат на токов удар, механична или друга опасност.

警告 (ZH-CN)

本维修手册仅提供英文版本。

- 如果客户的维修服务人员需要非英文版本，则客户需自行提供翻译服务。
- 未详细阅读和完全理解本维修手册之前，不得进行维修。
- 忽略本警告可能对维修服务人员、操作人员或患者造成电击、机械伤害或其他形式的伤害。

警告 (ZH-HK)

本服務手冊僅提供英文版本。

- 倘若客戶的服務供應商需要英文以外之服務手冊，客戶有責任提供翻譯服務。
- 除非已參閱本服務手冊及明白其內容，否則切勿嘗試維修設備。
- 不遵從本警告或會令服務供應商、網絡供應商或病人受到觸電、機械性或其他的危險。

警告 (ZH-TW)

本維修手冊僅有英文版。

- 若客戶的維修廠商需要英文版以外的語言，應由客戶自行提供翻譯服務。
- 請勿試圖維修本設備，除非 您已查閱並瞭解本維修手冊。
- 若未留意本警告，可能導致維修廠商、操作員或病患因觸電、機械或其他危險而受傷。

UPOZORENJE (HR)

Ovaj servisni priručnik dostupan je na engleskom jeziku.

- Ako davatelj usluge klijenta treba neki drugi jezik, klijent je dužan osigurati prijevod.
- Ne pokušavajte servisirati opremu ako niste u potpunosti pročitali i razumjeli ovaj servisni priručnik.
- Zanemarite li ovo upozorenje, može doći do ozljede davatelja usluge, operatera ili pacijenta uslijed strujnog udara, mehaničkih ili drugih rizika.

VÝSTRAHA (CS)

Tento provozní návod existuje pouze v anglickém jazyce.

- V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka.
- Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah.
- V případě nedodržování této výstrahy může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.

ADVARSEL (DA)

Denne servicemanual findes kun på engelsk.

- Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse.
- Forsøg ikke at servicere udstyret uden at læse og forstå denne servicemanual.
- Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk stød, mekanisk eller anden fare for teknikeren, operatøren eller patienten.

WAARSCHUWING (NL)

Deze onderhoudshandleiding is enkel in het Engels verkrijgbaar.

- Als het onderhoudspersoneel een andere taal vereist, dan is de klant verantwoordelijk voor de vertaling ervan.
- Probeer de apparatuur niet te onderhouden alvorens deze onderhoudshandleiding werd geraadpleegd en begrepen is.
- Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de operator of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.

WARNING (EN)

This service manual is available in English only.

- If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.
- Do not attempt to service the equipment unless this service manual has been consulted and is understood.
- Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

HOIATUS (ET)

See teenindusjuhend on saadaval ainult inglise keeles.

- Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest.
- Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist.
- Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.

VAROITUS (FI)

Tämä huolto-ohje on saatavilla vain englanniksi.

- Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla.
- Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen.
- Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.

ATTENTION (FR)

Ce manuel d'installation et de maintenance est disponible uniquement en anglais.

- Si le technicien d'un client a besoin de ce manuel dans une langue autre que l'anglais, il incombe au client de le faire traduire.
- Ne pas tenter d'intervenir sur les équipements tant que ce manuel d'installation et de maintenance n'a pas été consulté et compris.
- Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.

WARNUNG (DE)

Diese Serviceanleitung existiert nur in englischer Sprache.

- Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen.
- Versuchen Sie nicht diese Anlage zu warten, ohne diese Serviceanleitung gelesen und verstanden zu haben.
- Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.

ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)

Το παρόν εγχειρίδιο σέρβις διατίθεται μόνο στα αγγλικά.

- Εάν ο τεχνικός σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει τις υπηρεσίες μετάφρασης.
- Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό αν δεν έχετε συμβουλευτεί και κατανοήσει το παρόν εγχειρίδιο σέρβις.
- Αν δεν προσέξετε την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στον τεχνικό σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.

FIGYELMEZTETÉS (HU)

Ezen karbantartási kézikönyv kizárólag angol nyelven érhető el.

- Ha a vevő szolgáltatója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészíttetése.
- Ne próbálja elkezdeni használni a berendezést, amíg a karbantartási kézikönyvben leírtakat nem értelmezték.
- Ezen figyelmeztetés figyelmen kívül hagyása a szolgáltató, működtető vagy a beteg áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.

AÐVÖRUN (IS)

Þessi þjónustuhandbók er aðeins fáanleg á ensku.

- Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu.
- Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin.
- Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.

AVVERTENZA (IT)

Il presente manuale di manutenzione è disponibile soltanto in lingua inglese.

- Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione.
- Procedere alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto.
- Il mancato rispetto della presente avvertenza potrebbe causare lesioni all'addetto alla manutenzione, all'operatore o ai pazienti provocate da scosse elettriche, urti meccanici o altri rischi.

警告 (JA)

このサービスマニュアルには英語版しかありません。

- サービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
- このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないでください。
- この警告に従わない場合、サービスを担当される方、操作員あるいは患者 さんが、感電や機械的又はその他の危険により負傷する可能性があります。

경고 (KO)

본 서비스 매뉴얼은 영어로만 이용하실 수 있습니다.

- 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우, 번역 서비스를 제공하는 것은 고객의 책임입니다.
- 본 서비스 매뉴얼을 참조하여 숙지하지 않은 이상 해당 장비를 수리하려고 시도하지 마십시오.
- 본 경고 사항에 유의하지 않으면 전기 쇼크, 기계적 위험, 또는 기타 위험으로 인해 서비스 제공자, 사용자 또는 환자에게 부상을 입힐 수 있습니다.

BRĪDINĀJUMS (LV)

Šī apkopes rokasgrāmata ir pieejama tikai angļu valodā.

- Ja klienta apkopes sniedzējam nepieciešama informācija citā valodā, klienta pienākums ir nodrošināt tulkojumu.
- Neveiciet aprīkojuma apkopi bez apkopes rokasgrāmatas izlasīšanas un saprašanas.
- Šī brīdinājuma neievērošanas rezultātā var rasties elektriskās strāvas trieciena, mehānisku vai citu faktoru izraisītu traumu risks apkopes sniedzējam, operatoram vai pacientam.

ĮSPĖJIMAS (LT)

Šis eksploatavimo vadovas yra tik anglų kalba.

- Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, suteikti vertimo paslaugas privalo klientas.
- Nemėginkite atlikti įrangos techninės priežiūros, jei neperskaitėte ar nesupratote šio eksploatavimo vadovo.
- Jei nepaisysite šio įspėjimo, galimi paslaugų tiekėjo, operatoriaus ar paciento sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų.

ADVARSEL (NO)

Denne servicehåndboken finnes bare på engelsk.

- Hvis kundens serviceleverandør har bruk for et annet språk, er det kundens ansvar å sørge for oversettelse.
- Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått.
- Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.

OSTRZEŻENIE (PL)

Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim.

- Jeśli serwisant klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta.
- Nie próbować serwisować urządzenia bez zapoznania się z niniejszym podręcznikiem serwisowym i zrozumienia go.
- Niezastosowanie się do tego ostrzeżenia może doprowadzić do obrażeń serwisanta, operatora lub pacjenta w wyniku porażenia prądem elektrycznym, zagrożenia mechanicznego bądź innego.

ATENÇÃO (PT-BR)

Este manual de assistência técnica encontra-se disponível unicamente em inglês.

- Se outro serviço de assistência técnica solicitar a tradução deste manual, caberá ao cliente fornecer os serviços de tradução.
- Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica.
- A não observância deste aviso pode ocasionar ferimentos no técnico, operador ou paciente decorrentes de choques elétricos, mecânicos ou outros.

ATENÇÃO (PT-PT)

Este manual de assistência técnica só se encontra disponível em inglês.

- Se qualquer outro serviço de assistência técnica solicitar este manual noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução.
- Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica.
- O não cumprimento deste aviso pode colocar em perigo a segurança do técnico, do operador ou do paciente devido a choques eléctricos, mecânicos ou outros.

ATENŢIE (RO)

Acest manual de service este disponibil doar în limba engleză.

- Dacă un furnizor de servicii pentru clienţi necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere.
- Nu încercaţi să reparaţi echipamentul decât ulterior consultării şi înţelegerii acestui manual de service.
- Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.

ОСТОРОЖНО! (RU)

Данное руководство по техническому обслуживанию представлено только на английском языке.

- Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует самостоятельно обеспечить перевод.
- Перед техническим обслуживанием оборудования обязательно обратитесь к данному руководству и поймите изложенные в нем сведения.
- Несоблюдение требований данного предупреждения может привести к тому, что специалист по техобслуживанию, оператор или пациент получит удар электрическим током, механическую травму или другое повреждение.

UPOZORENJE (SR)

Ovo servisno uputstvo je dostupno samo na engleskom jeziku.

- Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilačke usluge.
- Ne pokušavajte da opravite uređaj ako niste pročitali i razumeli ovo servisno uputstvo.
- Zanemarivanje ovog upozorenja može dovesti do povređivanja servisera, rukovaoca ili pacijenta usled strujnog udara ili mehaničkih i drugih opasnosti.

UPOZORNENIE (SK)

Tento návod na obsluhu je k dispozícii len v angličtine.

- Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka.
- Nepokúšajte sa o obsluhu zariadenia, kým si neprečítate návod na obluhu a neporozumiete mu.
- Zanedbanie tohto upozornenia môže spôsobiť zranenie poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanické alebo iné ohrozenie.

ATENCION (ES)

Este manual de servicio sólo existe en inglés.

- Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual.
- No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio.
- La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.

VARNING (SV)

Den här servicehandboken finns bara tillgänglig på engelska.

- Om en kunds servicetekniker har behov av ett annat språk än engelska, ansvarar kunden för att tillhandahålla översättningstjänster.
- Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken.
- Om du inte tar hänsyn till den här varningen kan det resultera i skador på servicetekniker, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.

OPOZORILO (SL)

Ta servisni priročnik je na voljo samo v angleškem jeziku.

- Če ponudnik storitve stranke potrebuje priročnik v drugem jeziku, mora stranka zagotoviti prevod.
- Ne poskušajte servisirati opreme, če tega priročnika niste v celoti prebrali in razumeli.
- Če tega opozorila ne upoštevate, se lahko zaradi električnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.

DİKKAT (TR)

Bu servis kılavuzunun sadece ingilizcesi mevcuttur.

- Eğer müşteri teknisyeni bu kılavuzu ingilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer.
- Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz.
- Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.

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Revision History

Part / Rev	Date	Reason for change	Pages
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Chapter 1 Conformance Statement Overview

1 Conformance Statement Overview

The Optima system provides sophisticated image processing and storage functions. Optima system will provide support for DICOM 3.0 to achieve interoperability across equipment produced by different vendors.

Table 1-1 provides an overview of the network services supported by Optima system.

Table 1-1:

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Secondary Capture Image Storage	Yes	No
X-Ray Angiographic Image Storage	Yes	No
X-Ray Radiation Dose SR Image Storage	Yes	No
Workflow Management		
Storage Commitment Push Model SOP Class	Yes*	No
Modality Performed Procedure Step SOP Class	Yes*	No
Modality Worklist Information Model – FIND SOP Class	Yes*	No

Option*: This means that this service can be purchased separately

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Chapter 2 Introduction

1 Introduction

1.1 Overview

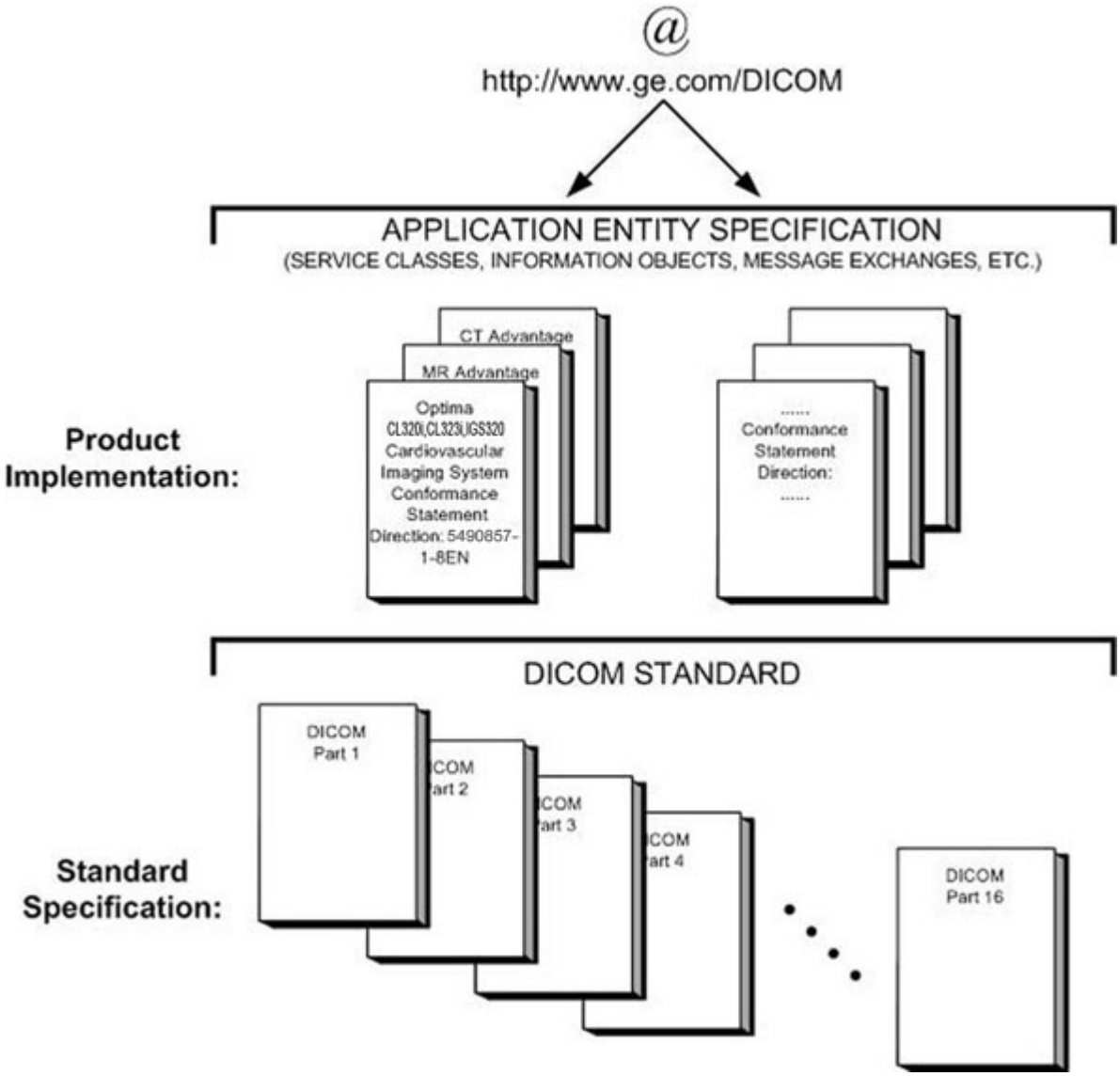
This DICOM Conformance Statement is divided into Chapters as described below:

- **Chapter 1 (Conformance Statement Overview)**, which describes the purpose of this Conformance Statement.
- **Chapter 2 (Introduction)**, which describes the overall structure, intent, and references for this Conformance Statement.
- **Chapter 3 (Network Conformance Statement)**, which specifies the GEMS equipment compliance to the DICOM requirements for the implementation of Networking features.
- **Chapter 4 (X–Ray Angiography Information Object Implementation)**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a X–Ray Angiography Information Object.
- **Chapter 5 (Secondary capture Information Object Implementation)**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary capture Information Object.
- **Chapter 6 (Modality Worklist Information Model)**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Modality Worklist service.
- **Chapter 7 (Storage Commitment Information Model Implementation)**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Storage Commitment service.
- **Chapter 8 (Modality Performed Procedure Step)**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Modality Performed Procedure Step Service.
- **Chapter 9 (X-ray Radiation Dose Structured Report)**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a X-ray Radiation Dose Structured Report Object.

1.2 Overall Dicom Conformance Statement Document Structure

The Documentation Structure of the GEMS Conformance Statements and their relationship with the DICOM Conformance Statements is shown in the Illustration below.

Illustration 2-1: GEMS DICOM Conformance Statements



This document specifies the DICOM implementation. It is entitled:

Optima™ CL320i, CL323i, IGS 320 Cardiovascular Imaging System

Conformance Statement for DICOM

Direction 5490857-1-8EN

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEMS network interface.

The GEMS Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1847
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

1.3 Intended Audience

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

1.4 Scope and Field Application

It is the intent of this document to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM. The GEMS Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEMS implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEMS devices.

1.5 Important Remarks

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter–operation will be successful**. The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** – The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the **user's** responsibility and should

not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.

- **Validation** – Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

  Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** – GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements.** The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.

- **Interaction** – It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 References

NEMA PS3:

Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/.

1.7 Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitons of these terms.

Abstract Syntax
The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE)

An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title

The externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context

The specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association

A network communication channel set up between *Application Entities*.

Attribute

A unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD)

The specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG)

A set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile

The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs).

Module

A set of Attributes within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation

First phase of Association establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context

The set of DICOM network services used over an Association, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU)

A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile

A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data.

Service Class Provider (SCP)

Role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity (Service Class User)*. Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU)

Role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU).

Service/Object Pair (SOP) Class

The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance

An information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag

A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element].

Transfer Syntax

The encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID)

A globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR)

The format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.8 Symbols and Abbreviations

AE
Application Entity

AET

Application Entity Title

DICOM

Digital Imaging and Communications in Medicine

DPPS

Data Points Per Second

IOD

Information Object Definition

MWL

Modality Worklist

MPPS

Modality Performed Procedure Step

PACS

Picture Archiving and Communication System

SC

Secondary Capture

SCP

Service Class Provider

SCU

Service Class User

SOP

Service-Object Pair

SPS

Scheduled Procedure Step

SR

Structured Report

VR

Value Representation

VM

Value Multiplicity

XA

X-ray Angiography

Chapter 3 Network Conformance Statement

1 Introduction

This section of the DICOM Conformance Statement specifies the Optima product compliance to DICOM requirements for **Networking** features.

This section details the roles and the DICOM Service Classes the System supports.

The Optima System DICOM implementation allows:

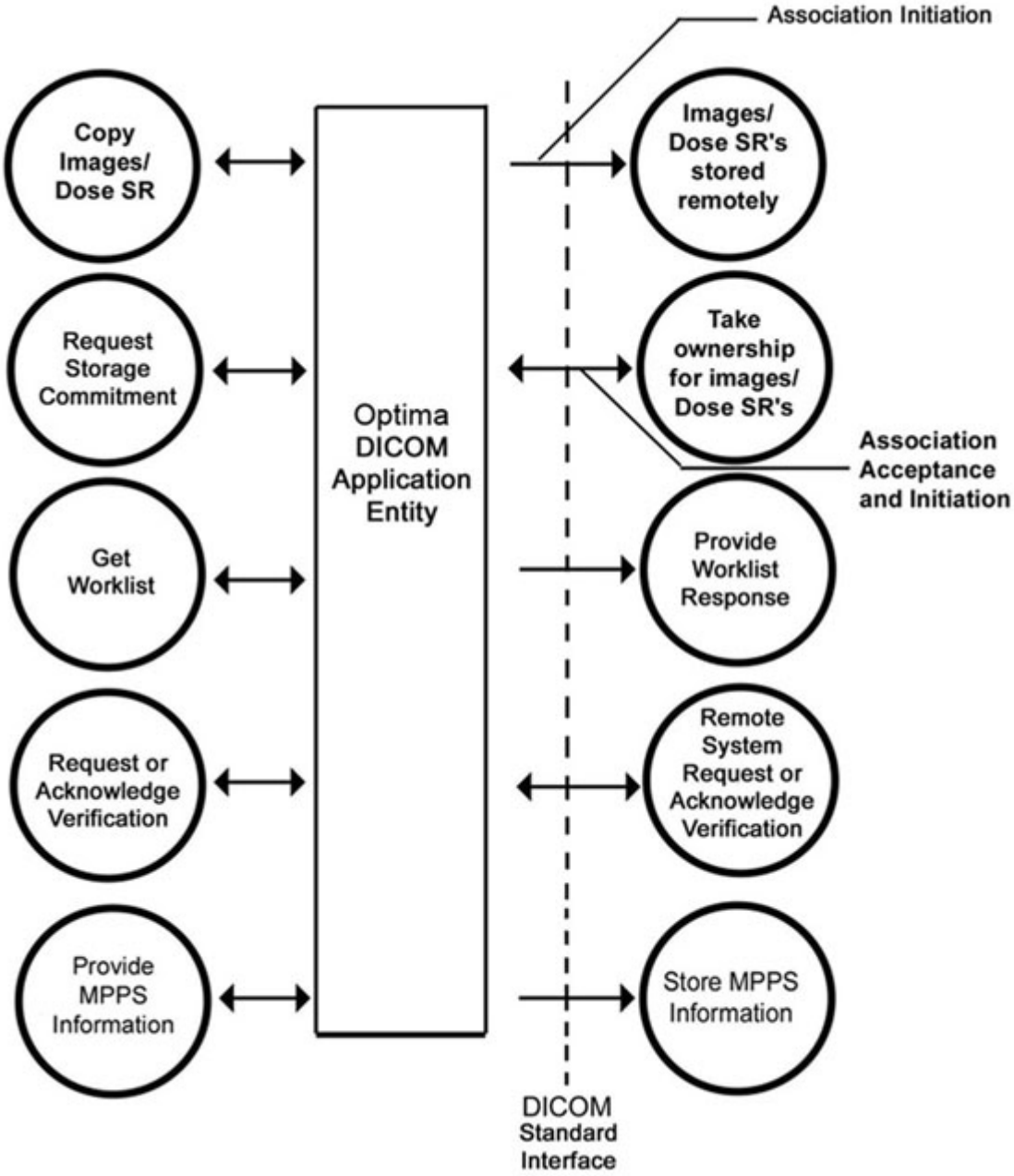
- The user to copy Optima images and/or Radiation Structured Dose Reports acquired through the system to a remote DICOM Application Entity, using the Standard Storage DICOM Service as a Service Class User.
- The user to request storage commitment for Optima images and/or Radiation Structured Dose Reports that were previously sent trough the system to a remote DICOM application entity, using the Storage Commitment Service as a Service Class User.
- The user to check the application level communication from the Optima DICOM Server to a remote DICOM Application Entity. To this aim the Optima System uses the Verification DICOM Service Class as a Service Class User.
- The user to get from the Radiology Information System (RIS) the list of procedure to be performed. This is done using the Basic Worklist Management DICOM Service as a Service Class User.
- A remote Application Entity to check the application level communication with the Optima System. This is done by providing the Verification DICOM Service Class as a Service Class Provider.
- To inform a remote DICOM Application Entity that a specific Procedure Step has been started (using N-CREATE messages) and later that this Procedure Step has been completed or discontinued (using N-SET messages). This is done by using the Modality Performed Procedure Step service as a Service Class User.

2 Implementation Model

2.1 Application Data Flow Diagram

The network application model for the Optima is shown in the following Illustration:

Illustration 3-1: Optima Network Application Model and Data Flow Diagram



The Optima DICOM Application Entity is an application which handles DICOM protocol communication. Optima DICOM AE is automatically brought up when the Optima system is powered on.

All remote DICOM AE must be manually configured on the Optima, usually at the software installation time, by a GE Field Engineer.

There are five local Real World activities which can cause the Optima DICOM AE to initiate a DICOM association:

- Copy Images/Dose SR,
- Request Storage Commitment for a set of images and/or Dose SR's,
- Get Worklist,
- Verification,
- Provide MPPS.

Copy Image consists of an operator selecting one or several images through the User Interface known as "Browser" and "Viewer". Selection of Remote System and visualization of the transfer status is done in a specific screen. The remote system can be any DICOM storage SCP supporting XA modality.

Copy Dose SR consists of automatic Dose SR transactions generated by the system during the termination of the exam. Also can be optionally transferred through the User Interface known as "Browser". Selection of Remote System and visualization of the transfer status is done in a specific screen in Browser. The remote system can be any DICOM storage SCP supporting X-Ray Radiation Dose Structured Report Information Object.

Request storage commitment consists of an automatic request performed by the system after each successful image transfer or after each successful Dose SR transfer to request Transfer of Ownership for the Images and Dose SR's that have been transferred earlier by the Copy Image/ Dose SR real world activity. The remote system shall be a DICOM Storage Commitment SCP.

Get Worklist activity consists of an operator request for the transfer of a list of procedure to be performed on the Optima acquisition system from a remote HIS/RIS system. The Remote system can be any DICOM modality worklist SCP.

Query keys can be entered for the following items:

- Patient Name
- Patient ID
- Accession number
- Procedure ID.

The system can be configured to query for its own modality (XA) or AE Title.

A date or a date range for the query can also be specified.

Verification consists of an operator request for the verification of the availability of a remote station.

Provide MPPS Information entity consists of automatic MPPS transactions generated by the system during the start and termination of the exam. Selection of Remote System and visualization of the transfer status is done in a specific screen in Browser. The remote system can be any DICOM SCP supporting MPPS.

2.2 Functional Definition of AE's

The Optima DICOM Application Entity supports the following five SCU functions

1. Copy images/Dose SR's:
   - Access to patient demographics, dose data and pixel Data in the local database
   - Build a DICOM Dataset
   - Initiate a DICOM Association to send the image(s) and/or Dose SR's
   - Send Images and/or Dose SR's
   - Close the association
2. Request Storage Commitment:
   - Initiate a DICOM Association in order to request Storage Commitment for the sent image(s) and/or Dose SR's.
   - Send the N–ACTION request.
   - Wait for the N–ACTION–RSP response.
   - Close the Association.
   - Receive N–EVENT–REPORT request in a separate association.
   - Send the N–EVENT–REPORT response.
   - Optionally, in the same association opened for N-ACTION request, the system can wait for a configurable delay to receive the N–EVENT–REPORT request and send the N-EVENT-REPORT response in the same association.
   - The system will accept a configurable number of DICOM associations from the Storage Commitment SCP to receive storage commitment responses.
3. Get worklist:
   - Build a DICOM formatted basic worklist management data request
   - Initiate a DICOM Association to send the request
   - Wait for worklist response(s)
   - Access to the local database to add new patient / exam demographic data
   - Close the association
4. Verification:

- Initiate a DICOM Association
- Send the C–ECHO request
- Wait for the C–ECHO response
- Close the Association

5. Provide MPPS Information
   - User selects one MWL entry (scheduled case) [OR] User selects no MWL entry and manually creates a patient (un-scheduled case) and starts the exam.
   - At the start of an exam, build a MPPS N-CREATE DICOM message.
   - Initiate a DICOM association to send the N-CREATE request.
   - Wait for the response.
   - Close the Association.
   - At the termination of the exam, build a MPPS N-SET DICOM message mentioning the status as ‘COMPLETED’ or ‘DISCONTINUED’.
   - Initiate a DICOM association to send the N-SET request.
   - Wait for the response.
   - Close the Association.

The Optima DICOM Application Entity also serves a default SCP function, the Verification Service Class, independently from others SCU functions.

2.3 Sequencing of Real–World Activities

Not Applicable.

3 AE Specifications

3.1 Optima AE Specification

The Optima Application Entity provides Standard Conformance to the following DICOM SOP Classes as an SCU and/or as an SCP:

Table 3-1:

SOP Class Name	SOP Class UID	SCU	SCP
Verification SOP Class	1.2.840.10008.1.1	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
X-Ray Radiation Dose SR Image Storage	1.2.840.10008.5.1.4.1.1.88.67	Yes	No
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No

3.2 Association Establishment Policies

3.2.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Table 3-2:

Application Context Name	1.2.840.10008.3.1.1.1

The maximum length PDU receive size for the Optima Application Entity is:

Table 3-3:

Maximum Length PDU	1024 Kbytes

NOTE: This value is not configurable.

3.2.2 Number of Associations

The Optima Application Entity will initiate a maximum of 1 association at a time for each service to remote nodes.

The Optima Application Entity will support a maximum of 5 simultaneous associations initiated by remote nodes for the Storage Commitment Push Model.

3.2.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

3.2.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

Table 3-4:

Optima Implementation UID	1.2.840.113619.6.335
Optima Implementation Version Name	Optima CL320i,CL323i,IGS320

3.3 Association Initiation Policy

When the Optima Application Entity initiates an Association for any Real-World Activity, it will propose the Presentation Contexts for all Real-World Activities; i.e., there is only a single, comprehensive Presentation Context Negotiation proposed for the AE.

The Optima proposes only a single Transfer Syntax in each Presentation Context; i.e., for each Abstract Syntax in the following Presentation Context Tables, the AE proposes one Presentation Context for each specified Transfer Syntax.

3.3.1 Real–World Activity Copy Images and/or Dose SR's

3.3.1.1 Associated Real–World Activity

The operator must select a destination in the User Interface towards which the images/Dose SR's will be transferred. For Images, one of the two following scenarios is possible:

1. The operator selects data to be sent to the destination through the User Interface. Once these selections are done, the user clicks on the "Network" button to initiate a "Copy images" operation. The Optima DICOM AE will then initiate a DICOM association with the selected destination and transfer the selected images on this association.
2. If system is configured for autoarchive, the Optima DICOM AE will automatically initiate a DICOM association with the selected destination to transfer any new image created on the system.

For Dose SR's, one of the two following scenarios is possible:

1. The operator selects data to be sent to the destination through the User Interface. Once these selections are done, Optima DICOM AE will automatically initiate a DICOM association with the selected destination to transfer the Dose SR's at every termination of an exam.
2. The user can manually initiate to transfer Dose SR to selected destination through the Browser operation and transfer the selected Dose SR's.

3.3.1.2 Proposed Presentation Context Table

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
X–Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
X–Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
X-Ray Radiation Dose SR Image Storage	1.2.840.10008.5.1.4.1.1.88.67	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
X-Ray Radiation Dose SR Image Storage	1.2.840.10008.5.1.4.1.1.88.67	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

SOP Specific DICOM Conformance Statement for all Storage SOP Classes:

This implementation can perform multiple C-STORE operation over a single association. Multiple C-STORE operation is used only to send images.

Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this implementation will terminate the association. No new association will be opened.

Upon receiving a C-STORE confirmation containing a status other than Successful or Warning, this implementation will consider the current request to be a failure. A new association will be opened to send remaining images.

This implementation can perform multiple C-STORE operation over a single association. Establishing an association supports an “Association Timer”. This timer starts when the association request is sent and stops when the Association response is received. The time out value is 10 seconds. This Association time out value is not configurable in the system.

If the above time out expires, the association is closed and the operation in progress is considered to be failed.

After sending the C-STORE requests, system waits for a configurable Push Time out (default value is 45 seconds) to receive the C-STORE response from the storage provider(s). If the storage provider(s) did not send the response within this time interval, system times out and the C-STORE operation will be considered to be FAILED.

Upon receiving a C-STORE response containing a Successful or Warning status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Following are the status codes that are more specifically processed when receiving messages from a Storage SCP equipment.

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A7xx	Out of resources	"Send" operation failed. Root cause indicated in error log. Will continue to attempt any remaining send operations.	(0000,0902)
	0122	SOP Class not Supported	"Send" operation failed. Root cause indicated in error log. Will continue to attempt any remaining send operations.	(0000,0902)
Error	Cxxx	Cannot Understand	"Send" operation failed. Root cause indicated in error log. Will continue to attempt any remaining send operations.	(0000,0901) (0000,0902)
	A9xx	Data Set does not match SOP Class	"Send" operation failed. Root cause indicated in error log. Will continue to attempt any remaining send operations.	(0000,0901) (0000,0902)
Warning	B000	Coercion of Data Elements	“Send” operation successful	None
	B007	Data Set does not match SOP Class	“Send” operation successful	None
	B006	Elements Discarded	“Send” operation successful	None
Success	0000	Success	“Send” operation successful	None

3.3.2 Real–World Activity Verification Acknowledge

3.3.2.1 Associated Real–World Activity

The operator must select a destination in the User Interface and press the “Verification” button. These operations will cause:

- the Optima DICOM Application Entity to initiate a DICOM association
- the Optima DICOM Application Entity to emit a C–ECHO command to check if the remote AE is available

3.3.2.2 Proposed Presentation Context Table

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

SOP Specific DICOM Conformance Statement for Verification SOP Class:

The Optima DICOM AE provides standard conformance to the DICOM Verification SOP class.

NOTE: The default timeout to receive the C-ECHO response is 30 secs and is not configurable.

3.3.3 Real-World Activity Get Worklist

3.3.3.1 Associated Real-World Activity

The worklist transfer can be initiated either automatically when the DL application starts, or manually by either clicking the “Refresh” button in the Patient Browser interface or the “Refresh now” button in the “Define Worklist Settings” screen.

These operation will cause:

- the Optima Application Entity to initiate a DICOM association
- the Optima DL application to build the C–FIND request
- the Optima Application Entity to emit the C–FIND request
- the Optima Application Entity to receive the C–FIND Reponse(s)
- the Optima Application Entity to close the association
- the possibility for the user to add a new item to the local database

While the query is in progress, it is possible to cancel it by pressing a button on the patient browser. This will cause a C–FIND cancel to be sent.

3.3.3.2 Proposed Presentation Context Table

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

SOP Specific DICOM Conformance Statement for the Modality Worklist Information Model – FIND SOP Class:

Following are the status codes that are more specifically processed when receiving messages from a Modality Worklist SCP equipment :

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Refused	A700	Out of resources	A message is displayed; with text “Last query failed” (more detailed information is logged in the error log).	(0000,0902)
	0122	SOP Class not Supported	A message is displayed; with text “Last query failed” (more detailed information is logged in the error log).	(0000,0902)

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
Failed	A900	Identifier does not match SOP class	Class A message is displayed; with text “Last query failed” (more detailed information is logged in the error log).	(0000,0901) (0000,0902)
	Cxxx	Unable to process	A message is displayed; with text “Last query failed” (more detailed information is logged in the error log).	(0000,0901) (0000,0902)
Cancel	FE00	Matching terminated due to cancel	A message is displayed; with text “Canceled”.	None
Success	0000	Matching is complete – No final identifier is supplied	Worklist matches are displayed.	None
Pending	FF00	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	None	None
	FF01	Matches are continuing – Warning that one or more Optional Keys were not supported for existence for this Identifier	None	None
*	*	Any other status code	A message is displayed; with text “Last query failed” (more detailed information is logged in the error log).	None

NOTE: The default timeout to receive the C-FIND response is 30 secs and is not configurable.

3.3.4 Real-World Activity Request Storage Commitment

3.3.4.1 Associated Real–World Activity

The operator may configure the image storage destination host and/or Dose SR storage destination host to have an associated Storage Commitment SCP AE (this can be the same AE as the Storage SCP). If there is an associated Storage Commitment SCP specified, after each successful image transfer and/or Dose transfer the system will automatically:

1. Wait for a configurable delay time (this allows re-routing of images / Dose SR’s from Storage SCP to the Storage Commitment SCP, if needed),
2. Initiate a DICOM association to the Storage Commitment SCP to send the storage commitment request.

3.3.4.2 Proposed Presentation Context Table

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.20.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class SCU:

The Storage Commitment will be requested for all SOP Instances for which the image transfer and/or Dose SR transfer was successful. Each request may include one or more SOP Instances, depending on the number of images that were transferred. For Dose SR's, each request includes only one SOP Instance.

The AE uses DICOM network storage services to transfer SOP Instances which are to be committed.

The AE may request Storage Commitment for Instances of any of the Composite SOP Classes it supports as an SCU (see Chapter 4, X-Ray Angiography (XA) Information Object Implementation, Chapter 5, SC Information Object Implementation and see Chapter 9, X-Ray Radiation Dose Structured Report Information Object).

The Storage Commitment will be requested for all SOP Instances for which the image transfer and/or Dose SR was successful.

The time-interval to attempt the Storage Commitment requests after the successful image transfer and/or Dose SR is configurable. The default value is 0 seconds (i.e., immediately after the image / Dose SR transfer).

Each Storage Commitment request (N-ACTION) may include one or more SOP Instances, depending on the numberof images that were transferred.

For Dose SR's, each request includes only one SOP Instance.

AE do not support the optional Storage Media File–Set ID and UID Attributes in the Storage Commitment N–ACTION for transfer of SOP Instances by media for Storage Commitment.

The Storage Commitment Information Object is described in Storage commitment push model information object definition (seeChapter 7, Storage commitment push model information object definition).

The AE will generate a new transaction UID at each new Storage commitment request (N–ACTION).

After sending the N-ACTION request to the storage commitment provider(s) and if the storage commitment provider(s) sends a busy signal [resource limitation] as a N-ACTION response, Optima AE can automatically retry sending the N-ACTION request to the storage commitment provider(s). The Maximum Number of Retries and the Delay between the retries is configurable. By default, the Maximum number of retries = 3 and Delay between auto-retries = 30 secs.

If the N-ACTION response conveys failure status, the association is closed by the AE.

Following are the status codes that are more specifically processed when receiving N-ACTION responses from a Storage Commitment SCP:

N-ACTION response Status Codes				
Service Status	**Status Codes**	**Further Meaning**	**Application Behavior When Receiving Status Codes**	**Related Fields Processed if Received**
Success	0000H	successful request	Waiting for storage commitment response	None
Failed	0213H	Resource limitation	Automatic retry of storage commitment request for a configurable number of times with a configurable delay between retries	None
Failed	Other than above	Failure reason other than resource limitation	Display error status in network queue	None

After receiving the successful N-ACTION response, AE will keep the association open for a configurable delay (default is 60 seconds). During this delay, AE will accept N-EVENT-REPORT requests sent by the remote SCP for the SOP instances referenced in the current N-ACTION request or any N-ACTION request(s) sent previously. The association is closed when this timeout expires and there is no active transaction performed by the system linked to this association.

If an N-EVENT-REPORT request is received on this association, the AE will process it, and send an N-EVENT-REPORT response on the same association. The association will not be closed by the AE even if the N-EVENT-REPORT conveys failure.

Upon receiving a Storage Commitment N–EVENT–REPORT (Storage Commitment Result), the Optima will mark all SOP Instances for which a success status is indicated. Only Patients, Studies or Instances marked “COMPLETED” may be deleted by user action without double confirmation.

If the Storage Commitment Result indicates any failure status, an error message will be displayed to the user, and the error, including the Failure Reason (0008,1197) attribute values, will be written to the error log. Any retry will be manually reinitiated.

On retry the AE will transfer again the instances, and then initiate a new Storage Commitment Request for them. The AE will process each Failure Reason Code as described below:

Failure Reason	Meaning	Application Behavior When Receiving Reason Code
0110H	Processing failure	Display error in network queue
0112H	No such object instance	Display error in network queue
0213H	Resource limitation	Display error in network queue
0122H	Referenced SOP Class not supported	Display error in network queue
0119H	Class/Instance conflict	Display error in network queue
0131H	Duplicate transaction UID	Display error in network queue
*	Any other status code	Display error in network queue

In case of the timeout, AE can receive N–EVENT–REPORT on the Association initiated by the Storage Commitment SCP Application Entity.

It will be processed as described for Association initiated by the Storage Commitment SCP (see Section 3.4.3).

The AE will return the standard status codes in N–EVENT–REPORT–RSP message as specified below:

Service Status	Status Codes	Further Meaning	Further Meaning
Failure	0119	Class-instance conflict	The specified SOP Instance is not a member of the specified SOP class.
	0112	No such SOP Instance	The SOP Instance UID specified implied a violation of the UID construction rules.
	0110	Processing failure	A general failure in processing the operation was encountered.
Success	0000		Successful notification.

3.3.5 Real-world Activity Send MPPS

3.3.5.1 Associated Real-world Activity

This implementation provides for simple transfer of procedure and image information using the DICOM Modality Performed Procedure Step SOP Class as a Service Class User (SCU).

The Performed Procedure Step N-CREATE message is sent automatically when the user starts the exam and after a worklist entry has been selected or patient data have been entered on the patient data entry screen. There is no operator intervention required.

The Performed Procedure Step N-SET message is sent automatically after the exam has been ended. There is no operator intervention required. If the operator successfully ended the exam, a COMPLETED status is sent. If the operator aborted the exam, a DISCONTINUED status is sent, and the user can select the discontinuation reason from a predefined list or add custom reason codes.

3.3.5.2 Proposed Presentation context table

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

SOP Specific DICOM Conformance Statement for Modality Performed Procedure Step SOP Class:

- Optima includes Attributes in the Modality Performed Procedure Step N-CREATE as described in Chapter 8, Modality Performed Procedure Step Implementation.
- Optima includes Attributes in the Modality Performed Procedure Step N-SET as described in Chapter 8, Modality Performed Procedure Step Implementation.
- Optima sends N-SET after the exam is ended. The N-SET will include all acquired images SOP Instance UIDs and the status of COMPLETED or DISCONTINUED. It will not include reference of the Secondary Capture Image SOP Instances.
- For this SOP class, all status codes with status Refused or Error are treated as failures and terminate the association and operation. All status codes with status Warning or Success are treated as successes.
- If either N-CREATE or N-SET fails, the MPPS transaction is considered to be failed.
- If N-CREATE fails, the corresponding N-SET will not be sent to the SCP. Re-sending failed MPPS, will re-send both N-CREATE and N-SET to the SCP.
- If N-CREATE succeeds and N-SET fails, Re-sending failed MPPS, will only re-send the failed N-SET to the SCP.

NOTE: The default timeout to receive the N-CREATE or N-SET response is 10 secs and is not configurable.

3.4 Association Acceptance Policy

3.4.1 Introduction

The Optima DICOM AE places no limitation on who may connect to it.

Any remote AE can open an association to the Optima DICOM AE for the purpose of application level communication verification.

3.4.2 Real-World Activity Verification Acknowledge

3.4.2.1 Associated Real-World Activity

The Optima DICOM AE is always listening to associations. No operator action is required to respond to a Verification request from any DICOM node.

3.4.2.2 Accepted Presentation Context Table

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.1.2	SCP	None

SOP Specific Conformance Statement for Verification SOP Class:

Optima DICOM Application provides standard conformance to the DICOM Verification Service Class.

NOTE: Optima AE will time-out 60 secs after Association Acknowledgment is sent and no Verification request is received. This time-out is not configurable.

3.4.3 Real–World Activity Request Storage Commitment

3.4.3.1 Associated Real–World Activity

The AE will accept a configurable number of DICOM associations to receive the storage commitment responses. The number of accepted associations can be configured from 1 to 5.

3.4.3.2 Accepted Presentation Context Table

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	Role Selection Negotiation
Storage Commitment Push Model	1.2.840.10008.1.20.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	Role Selection Negotiation
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Big Endian	1.2.840.10008.1.2.2	SCU	Role Selection Negotiation

SOP Specific DICOM Conformance Statement for the Storage Commitment Push Model SOP Class SCU:

The Optima accept the SCU role (which must be proposed via SCP/SCU Role Selection Negotiation) within a Presentation Context for the Storage Commitment Push Model SOP Class.

Upon receiving a Storage Commitment N–EVENT–REPORT (Storage Commitment Result), the Optima will mark all SOP Instances for which a success status is indicated in the user interface as successfully storage committed. When all Instances associated with a Study or a Patient are Archived, the Study or Patient will also be shown on the user interface with status “COMPLETED”. Only Patients, Studies or Instances marked “COMPLETED” may be deleted by user action without double confirmation.

If the Storage Commitment Result indicates any failure status, an error message will be displayed to the user, and the error, including the Failure Reason (0008,1197) attribute values, will be written to the error log. Any retry will be manually reinitiated. On retry the AE will transfer again the instances, and then initiate a new Storage Commitment Request for them.

The list of specific Failure Reason Codes that this AE will be able to process is described below.

Failure Reason	Meaning	Application Behavior When Receiving Reason Code
0110H	Processing failure	Display error in network queue
0112H	No such object instance	Display error in network queue
0213H	Resource limitation	Display error in network queue

Failure Reason	Meaning	Application Behavior When Receiving Reason Code
0122H	Referenced SOP Class not supported	Display error in network queue
0119H	Class/Instance conflict	Display error in network queue
0131H	Duplicate transaction UID	Display error in network queue
*	Any other status code	Display error in network queue

The AE will return the standard status codes in N–EVENT–REPORT–RSP message as specified below.

Service Status	Status Codes	Further Meaning	Further Meaning
Failure	0119	Class-instance conflict	The specified SOP Instance is not a member of the specified SOP class.
	0112	No such SOP Instance	The SOP Instance UID specified implied a violation of the UID construction rules.
	0110	Processing failure	A general failure in processing the operation was encountered.
Success	0000		Successful notification.

4 Communication Profiles

4.1 Supported Communication Stacks (PS 3.8)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

4.2 OSI Stack

OSI stack not supported

4.3 TCP/IP Stack

The TCP/IP stack is inherited from a Windows Operating System.

4.3.1 API

Not applicable to this product.

4.3.2 Physical Media Support

DICOM is indifferent to the Physical medium over which TCP/IP executes (e.g. Ethernet V2.0,IEEE 802.3, ATM, FDDI)

NOTE: For more information about the Physical Media available on OPTIMA System, please refer to the Product Data Sheet.

4.4 Additional Protocol Support

This product does not support DHCP.

4.5 IPv4 and IPv6 Support

This product supports only IPv4.

5 Extensions / Specializations / Privatizations

5.1 Standard Extended SOP Classes

The product provides Standard Extended Conformance to all supported SOP Classes, through the inclusion of additional Type 3 Standard Elements and Private Data Elements. The extensions are defined in Sections :

- Chapter 4, Chapter 4 X-Ray Angiography (XA) Information Object Implementation
- Chapter 5, Chapter 5 SC Information Object Implementation

6 Configuration

GEMS Field Service Engineers configure the OPTIMA System. The DICOM configuration items below are configurable or re–configurable by a Field Service Engineer.

6.1 AE Title/Presentation Address Mapping

The OPTIMA System DICOM SERVER AE allows for the configuration of the mapping of remote AE titles to IP addresses and ports. The IP address of a remote AE may be in a different sub net (using routing). GEMS Field Service Engineers perform this configuration.

6.2 Configurable Parameters

The following fields are configurable for this AE (local):

- Local AE Title
- Local IP Address
- Local IP Netmask

  NOTE: The local listening port number is not configurable for this product, and is equal to 4002.

The following field is configurable for the DICOM AE used as store SCP:

- Push Timeout - After the transfer of images, Optima waits for this maximum time period to receive the response from the storage provider(s).

The following fields are configurable for the DICOM AE used as storage commitment SCP:

- Delay after Push - After the images have been successfully exported to the receiving station, this parameter determines the amount of time Optima waits to attempt the Storage Commitment requests to the Storage Commitment provider(s).
- Request timeout - Amount of time the association is held open after the Storage Commitment request is sent. If the timeout is over, Optima will automatically release the association without receiving acknowledgement from the storage commitment provider(s). The default request timeout value is 60 sec.
- Maximum number of concurrent associations - Maximum number of simultaneous connections that Optima can accept from the storage commitment provider(s) to receive the storage commitment responses.
- Maximum number of automatic retry - After sending the Storage commitment request to the storage commitment provider(s) and if the storage commitment provider(s) sends a busy signal [resource limitation] as a Storage commitment response, this parameter determines the maximum number of times, Optima automatically retries sending the storage commitment request to the storage commitment provider(s).
- Delay between automatic retries - After sending the Storage commitment request to the storage commitment provider(s) and if the storage commitment provider(s) sends a busy signal

as a Storage commitment response, this parameter determines the delay between the automatic retries of Optima.

NOTE: A GE Field Engineer must perform all the above configurations.

The following fields are configurable for every remote DICOM AE used as Image storage SCP:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number
- Array size of the pixel data to be transferred (512x512, or any size up to 1024x1024).
- General Settings
  - 3D Reconstruct Host
  - Auto Push Default
    - Auto Push - If this parameter is set, at the end of every acquisition, Optima automatically pushes the images to the storage provider(s).

The following fields are configurable for every remote DICOM AE used as Image storage commitment SCP:

- Archive Station Option
- Remote Storage Commitment SCP AE Title
- Remote Storage Commitment SCP IP Address
- Remote Storage Commitment SCP Listening TCP/IP Port Number.

The following fields are configurable for every remote DICOM AE used as Dose SR storage SCP:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

The following fields are configurable for every remote DICOM AE used as Dose SR storage commitment SCP:

- Archive Station Option
- Remote Storage Commitment SCP AE Title
- Remote Storage Commitment SCP IP Address
- Remote Storage Commitment SCP Listening TCP/IP Port Number

The following fields are configurable for the DICOM AE used as worklist SCP:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number
- General Settings

  - Automatic Retrieve of Worklist at boot option
- The default request timeout value is 60sec

The following fields are configurable for the DICOM AE used as MPPS SCP:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

7 Support of Extended Character Sets

The Optima system generates only a single-byte character set ISO_IR 100 (Latin alphabet Number 1 supplementary set).

The product user interface will allow the user to enter characters from the console keyboard that are within ISO_IR 100 (Latin alphabet Number 1 supplementary set).

As a Modality Worklist SCU, the product will accept the worklist responses only if it satisfies the following:

- Attribute Specific Character Set (0008,0005) is not present
- Attribute Specific Character Set (0008,0005) has only a single value and the value is either ISO_IR 100 (or) ISO_IR 6
- Attribute Specific Character Set (0008,0005) has more than one value and the first value is either not present (or) ISO_IR 100 (or) ISO_IR 6

The product will reject the worklist responses that do not satisfy the conditions listed above.

Text attributes of the Scheduled Procedure Step Identifier, including Patient and Physician names, that include extended characters will be displayed considering only the first character set and hence only the first component group will be used. All other component groups of Person names will be ignored by the system.

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Chapter 4 X-Ray Angiography (XA) Information Object Implementation

1 Introduction

This section specifies the use of the DICOM X-Ray Angiographic Image IOD to represent the information included in X-Ray Angiographic Images produced by this implementation.

Corresponding attributes are conveyed using the module construct.

2 Optima Mapping of DICOM Entities

The Optima maps DICOM Information Entities to local Information Entities in the product's database and user interface.

Table 4-1: Mapping of DICOM Entities to Optima Entities

DICOM	Optima Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Exam
Patient	Patient

3 IOD Module Table

The X-Ray Angiographic Image Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section Section 5.1, Standard Attributes.

Table 4-2: X-Ray Angiographic Image IOD Modules

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Section 4.1, Patient Entity Modules
	Clinical Trial Subject	Not Used	N/A
Study	General Study	Used	Section 4.2.1, General Study Module
	Patient Study	Used	Section 4.2.2, Patient Study Module
	Clinical Trial Study	Not Used	N/A
Series	General Series	Used	Section 4.3, Series Entity Modules
	Clinical Trial Series	Not Used	N/A
Frame of Reference	Synchronization	Not Used	N/A
Equipment	General Equipment	Used	Section 4.4, Equipment Entity Modules
Frame of Reference	Synchronization	Not Used	N/A
Image	General Image	Used	Section 4.5.1, General Image Module
	Image Pixel	Used	Section 4.5.2, Image Pixel Module
	Contrast/Bolus	Used Required if contrast media was used in this image.	Section 4.5.3, Contrast/Bolus Module
	Cine	Used Required if pixel data is Multi-Frame Cine data.	Section 4.5.4, Cine Module
	Multi-Frame	Used Required if pixel data is Multi-Frame Cine data.	Section 4.5.5, Multi–Frame Module
	Frame Pointers	Used	Section 4.5.6, Frame Pointers Module
	Mask	Used Required if the Image may be subtracted.	Section 4.5.7, Mask Module
	Display Shutter	Used	Section 4.5.8, Display Shutter Module
	Device	Not Used	N/A
	Intervention	Not Used	N/A
	Specimen	Not Used	N/A
	X-Ray Image	Used	Section 4.5.9, X-Ray Image Module

Entity Name	Module Name	Usage	Reference
	X-Ray Acquisition	Used	Section 4.5.10, X-Ray Acquisition Module
	X-Ray Collimator	Used	Section 4.5.11, X–Ray Collimator Module
	X-Ray Table	Used Required if image is created with table motion. May be present otherwise.	Section 4.5.12, X–Ray Table Module
	XA Positioner	Used	Section 4.5.13, XA Positioner Module
	DX Detector	Used	Section 4.5.14, DX Detector Module
	Overlay Plane	Not Used	N/A
	Multi-Frame Overlay	Not Used	N/A
	Modality LUT	Not Used	N/A
	VOI LUT	Used	Section 4.5.15, VOI LUT module
	SOP Common	Used	Section 4.5.16, SOP Common Module

4 Information Module Definitions

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the X-Ray Angiographic Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

4.1 Patient Entity Modules

Patient Module

Table 4-3: Patient Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	From user interface or worklist. When from user interface, value contains only last_name(restricted to 32 chars)^first_name(restricted to 31 chars). When from worklist, equals first component group.
Patient ID	(0010,0020)	2	From worklist or user interface. Restricted to 64 chars.
Patient's Birth Date	(0010,0030)	2	From user interface or worklist. Restricted to 8 chars. YYYYMMDD.
Patient's Sex	(0010,0040)	2	From user interface or worklist. "M", "F" or "O".
Other Patient ID	(0010,1000)	3	Other patient identifier or code. From Worklist or User Interface.
Issuer of Patient ID	(0010,0021)	3	From Worklist. Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID.
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	From Worklist. Attributes specifying or qualifying the identity of the issuer of the Patient ID, or scoping the Patient ID. Only a single Item shall be permitted in this sequence.
> Universal Entity ID	(0040,0032)	3	From Worklist. Universal or unique identifier for the Patient ID Assigning Authority. The authority identified by this attribute shall be the same as that of Issuer of Patient ID (0010,0021), if present.
> Universal Entity ID Type	(0040,0033)	1C	From Worklist. Standard defining the format of the Universal Entity ID (0040,0032). Required if Universal Entity ID (0040,0032) is present.
> Identifier Type Code	(0040,0035)	3	From Worklist. Type of Patient ID.
Other Patient IDs Sequence	(0010,1002)	3	From Worklist. A sequence of identification numbers or codes used to identify the patient. If present, shall contain one or more items.
> Patient ID	(0010,0020)	1	From Worklist. An identification number or code used to identify the patient.
> Issuer of Patient ID	(0010,0021)	1	From Worklist. Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID.

Attribute Name	Tag	Type	Attribute Description
>Type of Patient ID	(0010,0022)	1	From Worklist. The type of identifier in this item. Defined Terms: TEXT RFID BARCODE

4.2 Study Entity Modules

4.2.1 General Study Module

Table 4-4: General Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	From Worklist. Otherwise, Internally generated as follows: "registered prefix for GEMS" + ".2. Registered prefix within GEMS" + ".a.b.c" encoded mac address of the DL host +".x.y.z" unique id protected against reinstallation and re-entrance.
Study Date	(0008,0020)	2	YYYYMMDD, restricted to 8 characters.
Study Time	(0008,0030)	2	HHMMSS.XXX, restricted to 10 characters.
Referring Physician's Name	(0008,0090)	2	From User Interface or worklist, restricted to 64 characters.
Study ID	(0020,0010)	2	From User Interface or Worklist, restricted to 16 characters.
Accession Number	(0008,0050)	2	From User Interface or Worklist, restricted to 16 characters.
Study Description	(0008,1030)	3	Generated description from the worklist entries.If no value found,value is taken from user interface.
Name of Physician(s) Reading Study	(0008,1060)	3	From User Interface, restricted to 64 characters. Value contains only one component. (May not be sent).
Reference Study Sequence	(0008,1110)	3	From Worklist. The sequence may have zero or more Items.
>Reference SOP Class UID	(0008,1150)	1	From Worklist. Required if a sequence item is present.
>Reference SOP instance UID	(0008,1155)	1	From Worklist. Required if a sequence item is present.
Performed Procedure Code Sequence	(0008,1032)	3	A Sequence that conveys the type of procedure performed. Present if MPPS option is enabled. (May not be sent)
>Code Value	(0008,0100)	1C	Required if a sequence item is present.
>Code schema designator	(0008,0102)	1C	Required if a sequence item is present.
>Code meaning	(0008,0104)	1C	Required if a sequence item is present.

4.2.2 Patient Study Module

Table 4-5: Patient Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Either from User Interface or Calculated from Patient's Birth Date (0010,0030). Three digits followed by one letter: In Years (Y), Months (M), Weeks (W) or Days (D). (May not be sent).
Patient's Size	(0010,1020)	3	From User Interface or worklist, restricted to 16 characters. (May not be sent).

Attribute Name	Tag	Type	Attribute Description
Patient's Weight	(0010,1030)	3	From User Interface or worklist, restricted to 16 characters. (May not be sent).
Admission ID	(0038,0010)	3	From Worklist, Identification number of the visit as assigned by the healthcare provider. (May not be sent)

4.3 Series Entity Modules

General Series Module

Table 4-6: General Series Module Attributes

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	"XA"
Series Instance UID	(0020,000E)	1	Restricted to 64 characters, internally generated as follows: "registered prefix for GEMS" + ".2. Registered prefix within GEMS" + ".a.b.c" encoded mac address of the DL host +".x.y.z" unique id protected against reinstallation and reentrance.
Series Number	(0020,0011)	2	Internally generated, starting at 1.
Series Date	(0008,0021)	3	YYYYMMDD, restricted to 8 characters.
Series Time	(0008,0031)	3	HHMMSS.XXX, restricted to 10 characters.
Performing Physicians' Name	(0008,1050)	3	From User Interface, restricted to 64 characters.
Protocol Name	(0018,1030)	3	From User Interface, user defined description of the acquisition protocol.
Series Description	(0008,103E)	3	Internally generated Series Description using Study/RP/SPS information (May not be sent).
Operators' Name	(0008,1070)	3	From User Interface, restricted to 64 characters. (May not be sent).
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Uniquely identifies the Modality Performed Procedure Step SOP Instance. Present only if MPPS Option is enabled. (May not be sent).
>Reference SOP Class UID	(0008,1150)	1C	Uniquely identifies the MPPS SOP Class. Required if a sequence item is present.
>Reference SOP instance UID	(0008,1155)	1C	Uniquely identifies the MPPS SOP Instance. Required if a sequence item is present.

Attribute Name	Tag	Type	Attribute Description
Patient position	(0018,5100)	2C	Patient position descriptor relative to the equipment. Defined terms are: • HFP = Head First-Prone • HFS = Head First- Supine • HFDR = Head First-Decubitus Right • HFDL = Head First-Decubitus Left • FFDR = Feet First-Decubitus Right • FFDL = Feet First-Decubitus Left • FFP = Feet First-Prone • FFS = Feet First- Supine
Body Part Examined	(0018,0015)	3	Text description of the part of the body examined.
Request attribute sequence	(0040,0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have only one item.
>Request procedure id	(0040,1001)	1C	Identifier that identifies the Requested Procedure in the Imaging Service Request. Required if Sequence Item is present.
>Requested Procedure Description	(0032,1060)	3	Institution-generated administrative description or classification of Requested Procedure. (May not be sent)
>Requested procedure Code Sequence	(0032,1064)	3	A sequence that conveys the procedure Type of the requested procedure. The Requested Procedure Code Sequence shall contain only a single item.
>>Code Value	(0008,0100)	1C	Required if a sequence item is present.
>>Code schema designator	(0008,0102)	1C	Required if a sequence item is present.
>>Code meaning	(0008,0104)	1C	Required if a sequence item is present.
>Scheduled Procedure Step ID	(0040,0009)	1C	Identifier that identifies the Scheduled Procedure step.
>Scheduled Procedure Step Description	(0040,0007)	3	Institution-generated description or classification of the Scheduled Procedure Step to be performed.
>Scheduled Protocol Code Sequence	(0040,0008)	3	Sequence describing the Scheduled Protocol following a specific coding Scheme.
>>Code Value	(0008,0100)	1C	Required if a sequence item is present.
>>Code schema designator	(0008,0102)	1C	Required if a sequence item is present.
>>Code meaning	(0008,0104)	1C	Required if a sequence item is present.
Performed Procedure Step ID	(0040,0253)	3	Internally generated identifier.
Performed Procedure Step Start Date	(0040,0244)	3	Date on which the Performed Procedure step started. Same as Study Date.
Performed Procedure Step Start Time	(0040, 0245)	3	Time on which the Performed Procedure Step started. Same as Study Time.
Performed Procedure Step Description	(0040,0254)	3	description of the Procedure Step that was performed.

4.4 Equipment Entity Modules

General Equipment Module

Table 4-7: General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	“GE MEDICAL SYSTEMS”
Institution Name	(0008,0080)	3	From ”Service User Interface”, configured at the installation of the system. Restricted to 64 characters.
Institution Address	(0008,0081)	3	From ”Service User Interface”, configured at the installation of the system. Restricted to 1024 characters.
Station name	(0008,1010)	3	AE Title of the system that created the DICOM image.
Manufacturer’s Model Name	(0008,1090)	3	“DL”
Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment. From internal configuration of the machine.
Software Versions	(0018,1020)	3	DL application version.

4.5 Image Entity Modules

4.5.1 General Image Module

Table 4-8: General Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Internally generated, starting at 1.
Patient Orientation	(0020,0020)	2C	Patient direction of the rows and columns of the image. This attribute contains the values corresponding to the first frame.
Content Date	(0008,0023)	2C	Same as acquisition date (0008,0022).
Content Time	(0008,0033)	2C	Same as acquisition time (0008,0032).
Image Type	(0008,0008)	3	See Table 4-17: Image type
Acquisition Date	(0008,0022)	3	YYYYMMDD, restricted to 8 characters, date the sequence was acquired.
Acquisition Time	(0008,0032)	3	HHMMSS.XXX, restricted to 10 characters.
Image Comments	(0020,4000)	3	From User Interface, restricted to 64 characters.
Irradiation Event UID	(0008,3010)	3	Unique identification of the irradiation event(s) associated with the acquisition of this image.

4.5.2 Image Pixel Module

Table 4-9: Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	“1”
Photometric Interpretation	(0028,0004)	1	MONOCHROME2

Attribute Name	Tag	Type	Attribute Description
Rows	(0028,0010)	1	Depends on the size of the FOV (imaged region of the X-ray detector), and the re-sampling applied during the DICOM conversion. Possible values are 1024, 1000, 864, 736, 608, 750, 800, 512 and 500.
Columns	(0028,0011)	1	Depends on the size of the FOV (imaged region of the X-ray detector), and the re-sampling applied during the DICOM conversion. Possible values are 1024, 1000, 864, 736, 608, 750, 800, 512 and 500.
Bits Allocated	(0028,0100)	1	8 or 16
Bits Stored	(0028,0101)	1	8 or 12
High Bit	(0028,0102)	1	7 or 11
Pixel Representation	(0028,0103)	1	“0”
Pixel Data	(7FE0,0010)	1	Data stream of the pixel samples.

4.5.3 Contrast/Bolus Module

This module is used only if contrast media was used in this image.

Table 4-10: Contrast/Bolus Module Attributes

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	EMPTY

4.5.4 Cine Module

This module is used only if pixel data is Multi-Frame Cine data.

Table 4-11: Cine Module Attributes

Attribute Name	Tag	Type	Attribute Description
Frame Time	(0018,1063)	1C	Nominal time (in msec) between frames. Required if frame increment pointer (0028,0009) points to frame time.
Frame time vector	(0018,1065)	1C	An array which contains the real time increments (in msec) between frames for a Multi-frame image. Required if Frame Increment Pointer (0028,0009) points to Frame Time Vector. If exist, the interval time values of the intervals during acquisition (e.g. between two sections or segments).
Start Trim	(0008,2142)	3	The frame number of the next frame after the last trial image.
Stop Trim	(0008,2143)	3	Last frame of the multi–frame image.
Recommended Display Frame Rate	(0008,2144)	3	Number of frames per second (truncated to integer).
Cine Rate	(0018,0040)	3	Number of frames per second (truncated to integer).
Frame Delay	(0018,1066)	0	“0”.

4.5.5 Multi–Frame Module

This module is used only if pixel data is Multi-Frame Cine data.

Table 4-12: Multi–Frame Module Attributes

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Internally generated by acquisition system. Maximum: 460.
Frame Increment Pointer	(0028,0009)	1	“(0018,1063)”OR “(0018,1065)”

4.5.6 Frame Pointers Module

Table 4-13: Frame Pointers Module Attributes

Attribute Name	Tag	Type	Attribute Description
Representative Frame Number	(0028,6010)	3	Calculated as "start_trim + (stop_trim - start_trim)/2.

4.5.7 Mask Module

This module is used only if the image may be subtracted.

Table 4-14: Mask Module Attributes

Attribute Name	Tag	Type	Attribute Description
Mask Substraction Sequence	(0028,6100)	1	Defines a sequence which describe mask subtraction operations for a Multi–frame Image.
>Mask Operation	(0028,6101)	1	AVG_SUB or NONE
>Applicable Frame Range	(0028,6102)	1C	Frames of the mask operation applied during the last review.
>Mask Frame Numbers	(0028,6110)	1C	Frames selected as Mask during the last review. Required if Mask Operation (0028,6101) is AVG_SUB.
>Mask Subpixel Shift	(0028,6114)	3	Pixel shift applied during the last review.
Recommended Viewing Mode	(0028,1090)	2	SUB or NAT

4.5.8 Display Shutter Module

Table 4-15: Display Shutter Module Attributes

Attribute Name	Tag	Type	Attribute Description
Shutter Shape	(0018,1600)	1	“RECTANGULAR”
Shutter Left Vertical Edge	(0018,1602)	1C	Internally generated by acquisition system.
Shutter Right Vertical Edge	(0018,1604)	1C	Internally generated by acquisition system.
Shutter Upper Horizontal Edge	(0018,1606)	1C	Internally generated by acquisition system.
Shutter Lower Horizontal Edge	(0018,1608)	1C	Internally generated by acquisition system.

4.5.9 X-Ray Image Module

Table 4-16: X-Ray Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See Table 4-17: Image type

Attribute Name	Tag	Type	Attribute Description
Pixel Intensity Relationship	(0028,1040)	1	DISP, DRM or SQRT
Scan Options	(0018,0022)	3	Parameters of scanning sequence.
Calibration Image	(0050,0004)	3	Not sent
Samples per Pixel	(0028,0002)	1	See Table 4-9
Photometric Interpretation	(0028,0004)	1	See Table 4-9
Bits Allocated	(0028,0100)	1	See Table 4-9
Bits Stored	(0028,0101)	1	See Table 4-9
High Bit	(0028,0102)	1	See Table 4-9
Pixel Representation	(0028,0103)	1	See Table 4-9

Image Type

Values 1, 2, 3 have the following Enumerated Values:

Table 4-17: Image Type

Enumerated Values	
Value 1	ORIGINAL identifies an Original Image or DERIVED identifies an image whose pixel value have been derived
Value 2	PRIMARY identifies a Primary Image
Value 3	SINGLE PLANE

4.5.10 X-Ray Acquisition Module

Table 4-18: X-Ray Acquisition Module Attributes

Attribute Name	Tag	Type	Attribute Description
Acquisition duration	(0018,9073)	3	The time in seconds needed for the complete acquisition
KVP	(0018,0060)	2	Peak kilo voltage output of the Xray generator used.
Radiation Setting	(0018,1155)	1	Identify the general level of Xray dose exposure. Enumerated values are SC=low dose (fluoro), GR=high dose (cine).
X-Ray Tube Current	(0018,1151)	2C	Xray tube current in mA.
Exposure Time	(0018,1150)	2C	Duration of Xray exposure in msec.
Exposure	(0018,1152)	2C	The product of exposure time and Xray tube current expressed in mAs. Required if either Exposure Time (0018,1150) or Xray tube current (0018,1151) are not present.
Grid	(0018,1166)	3	Identify the grid.Defined Terms are IN(a grid is positioned) and NONE(no grid is used).
Average Pulse Width	(0018,1154)	3	Average width of Xray pulse in msec.
Radiation Mode	(0018,115A)	3	Specifies Xray radiation mode (CONTINUOUS, PULSED).

Attribute Name	Tag	Type	Attribute Description
Image and Fluoroscopy Area Dose product	(0018,115E)	3	XRay dose, measured in dGy*cm*cm, to which the patient was exposed for the acquisition of this image plus any Non-digitally recorded fluoro which may have been performed to prepare for the acquisition of this image.
Intensifier Size	(0018,1162)	3	204.8 for 20cm detector, 307.2 for 30cm detector and 409.6 for 40cm detector.
Focal Spot	(0018,1190)	3	Nominal focal spot size in mm used to acquire this image.
Type of Filters	(0018,1161)	3	Type of filter(s) inserted into the X-Ray beam (e.g. wedges)
Exposure in µAs	(0018,1153)	3	The exposure expressed in µAs, for example calculated from Exposure Time and X-Ray Tube Current

4.5.11 X–Ray Collimator Module

Table 4-19: X-Ray Collimator Module Attributes

Attribute Name	Tag	Type	Attribute Description
Collimator Shape	(0018,1700)	1	RECTANGULAR
Collimator Left Vertical Edge	(0018,1702)	1C	Internally generated by the acquisition system.
Collimator Right Vertical Edge	(0018,1704)	1C	Internally generated by the acquisition system.
Collimator Upper Horizontal Edge	(0018,1706)	1C	Internally generated by the acquisition system.
Collimator Lower Horizontal Edge	(0018,1708)	1C	Internally generated by the acquisition system.

4.5.12 X–Ray Table Module

Table 4-20: X-Ray Table Module Attributes

Attribute Name	Tag	Type	Attribute Description
Table Motion	(0018,1134)	2	Defined terms: STATIC, DYNAMIC. DYNAMIC if there is any movement in table or relative motion of table with respect to isocenter. NOTE: Table Motion may also be set to DYNAMIC when there is only a tilt table motion. In that specific case, Table Increments will be set to 0.
Table Vertical Increment	(0018,1135)	2C	Incremental change in Vertical position of the table plane relative to first frame of Multiframe image given in mm. Table motion down is positive. Required if Table Motion is DYNAMIC. NOTE: if the table is tilted, this attribute determines a change of the tilted plane in the vertical direction.

Attribute Name	Tag	Type	Attribute Description
Table Longitudinal Increment	(0018,1137)	2C	Incremental change in Longitudinal position of the table (in the table plane even if the table is tilted) relative to first frame of Multiframe image given in mm. Table motion towards CRA is positive. Required if Table Motion is DYNAMIC. NOTE: if the table is tilted and rotated, this attribute determines a change of the table in the tilted plane (not in the horizontal plane) and in the CRA-CAU direction of the isocenter system, which is fixed and independent from the rotation angle of the table.
Table Lateral Increment	(0018,1136)	2C	Incremental change in Lateral position of the table (in the horizontal plane) relative to first frame of Multiframe image given in mm. Table motion towards LAO is positive. Required if Table Motion is DYNAMIC. NOTE: If the table is rotated, this attribute determines a change of the table position in the LAO-RAO direction of the isocenter system, which is fixed and independent from the rotation angle of the table.
Table Angle	(0018,1138)	3	Angle of the head-feet axis of the table in degrees relative to the horizontal plane. Zero is defined when the head-feet axis is in the horizontal plane. Positive values are when the head of the table is upwards the horizontal plane. The valid range is from -45 to +45. Contains the maximum value of all the frames of the multi-frame image.

4.5.13 XA Positioner Module

Table 4-21: XA Positioner Module Attributes

Attribute Name	Tag	Type	Attribute Description
Distance Source to Patient	(0018,1111)	3	Internally generated by the acquisition system.
Distance Source to Detector	(0018,1110)	3	Internally generated by the acquisition system.
Estimated Radiographic Magnification Factor	(0018,1114)	3	Calculated from (0018,1110) and (0018,1111).
Positioner Motion	(0018,1500)	2C	DYNAMIC, if Pivot moves or C-ARM moves or L-arm moves or Tilt varies or Table rotation or ISO movement happens. If NO motion [in Pivot or C-arm or Tilt or Table rotation or ISO] then it will be sent as STATIC.
Positioner Primary Angle	(0018,1510)	2	Position of the Xray Image Intensifier about the patient from the RAO to LAO direction where movement from RAO to vertical is positive. For multi-frame images, value of the first frame. Note: The values correspond to the motions in Pivot, C, L-arm, Rotation, Tilt, Patient Position.

Attribute Name	Tag	Type	Attribute Description
Positioner Secondary Angle	(0018,1511)	2	Position of the Xray Image Intensifier about the patient from the CAU to CRA direction where movement from CAU to vertical is positive. For multi-frame images, value of the first frame. Note: The values correspond to the motions in Pivot, C, L-arm, Rotation, Tilt, Patient Position.
Positioner Primary Angle Increment	(0018,1520)	2C	Value of the RAO/LAO increments relative to the first frame. Required if positioner motion is DYNAMIC.
Positioner Secondary Angle Increment	(0018,1521)	2C	Value of the CRA/CAU increments relative to the first frame. Required if positioner motion is DYNAMIC.

4.5.14 DX Detector Module

Table 4-22: DX Detector Module Attributes

Attribute Name	Tag	Type	Attribute Description
Detector Type	(0018,7004)	2	SCINTILLATOR
Field of View Shape	(0018,1147)	3	RECTANGLE
Field of View Dimension(s)	(0018,1149)	3	From user selection in the User Interface of the acquisition system. Possible values are "400\400" OR "320\320" OR "300\300" OR "200\200" OR "172\172" OR "170\170" OR "160\160" OR "150\150" OR "147\147" OR "121\121" OR "120\120".
Field Of View Origin	(0018,7030)	1C	Depends on the size of the FOV (imaged region of the X-ray detector).
Field Of View Rotation	(0018,7032)	1C	Clockwise rotation in degrees of Field of View, that is the image pixels stored in Pixel Data , relative to the physical detector. Enumerated Values: 0, 90, 180, 270 Required if Field of View Horizontal Flip (0018,7034) is present.
Field of View Horizontal Flip	(0018,7034)	1C	Whether or not a horizontal flip has been applied to the Field of View, that is the image pixels stored in Pixel Data (7FE0,0010), after rotation relative to the physical detector as described in Field of View Rotation (0018,7032). Enumerated Values: NO YES Required if Field of View Rotation (0018,7032) is present.
Imager Pixel Spacing	(0018,1164)	1	Around 0.2 mm for FOV 120 mm to FOV 200 mm, and around 0.4 mm for FOV 200 mm and above.

4.5.15 VOI LUT module

Table 4-23: VOI LUT Module Attributes

Attribute Name	Tag	Type	Attribute Description
Window center	(0028,1050)	1C	Value of the window center optimized at the image acquisition.
Window width	(0028,1051)	1C	Value of the window width optimized at the image acquisition.

4.5.16 SOP Common Module

Table 4-24: SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	“1.2.840.10008.5.1.4.1.1.12.1”
SOP Instance UID	(0008,0018)	1	Restricted to 64 characters, internally generated as follows: ”registered prefix for GEMS” + ”.2. Registered prefix within GEMS” + ”.a.b.c” encoded mac address of the DL host +”.x.y.z” unique id protected against reinstallation and re-entrance.
Specific Character Set	(0008,0005)	1C	'ISO_IR 100'
Instance Number	(0020,0013)	3	Internally generated, starting at 1.

5 Standard Extended and Private Data Attributes

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended X-Ray Angiographic SOP Instances as Type 3 data elements.

5.1 Standard Attributes

The Product supports the following attributes, not specified in the X-Ray Angiographic IOD, in SOP Instances as Type 3 data elements.

Table 4-25: Standard Extended Attributes

Information Entity Name	Attribute Name	Tag	Use
Image	Curve Dimensions	(5000,0005)	"2"
	Number of Points	(5000,0010)	Number of data points in this Curve.
	Type of Data	(5000,0020)	"ECG"
	Data Value Representation	(5000,0103)	"0000H" [unsigned short (US)]
	Curve Data Descriptor	(5000,0110)	"0\1"
	Axis Units	(5000,0030)	"DPPS\NONE"
	Coordinate Start Value	(5000,0112)	"0"
	Coordinate Step Value	(5000,0114)	"250"
	Curve Data	(5000,3000)	Points in the curve, each dimension for the first point, followed by dimensions for second point, etc

5.2 Private Group DLX_SERIE_01

Private Group DLX_SERIE_01 is modeled as part of the Image Information Entity.

Table 4-26: Private Group DLX_SERIE_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
adx acq mode	(0019,xx14)	IS	1	This is a "numerical code" of the acquisition mode, and is used in AW to auto-start applications. Defined codes for Optima are: 100: Fluoro Store 2: Cardiac NoSub 32: Auto DSA 116: Bolus for Pasting (Angio Sub) 126: Chase 129: 3D Calibration 140: NoSub 3D 128: Sub 3D
ip address	(0019,xx20)	LO	1	IP address of the machine that sends the series.

Attribute Name	Tag	VR	VM	Attribute Description and Use
Lambda cm pincushion distortion	(0019,xx24)	DS	1	Coefficient of the pincushion distortion model of the Image Intensifier, in cm-1. This model allows correcting the position of a point of the image as function of the distance to the center of the image.
Slope LV regression	(0019,xx25)	DS	1	Slope coefficient (unit less) of the linear regression correction of the Left Ventricular volume. This linear regression corrects the Left Ventricular volume calculated by the Dodge's method from the contour of the left ventricle traced by an expert.
Intercept LV regression	(0019,xx26)	DS	1	Intercept coefficient (in cm3) of the linear regression correction of the Left Ventricular volume. This linear regression corrects the Left Ventricular volume calculated by the Dodge's method from the contour of the left ventricle traced by an expert.
table vertical position	(0019,xx21)	DS	1	Absolute Vertical position of the table (in mm) with respect to the table referential. Down moving is positive. The value of this attribute applies to the first frame of the Multi-frame image.
table longitudinal position	(0019,xx22)	DS	1	Absolute Longitudinal position of the table (in mm) with respect to the table referential. Head moving is positive. The value of this attribute applies to the first frame of the Multi-frame image.
table lateral position	(0019,xx23)	DS	1	Absolute Lateral position (in mm) of the table with respect to the table referential. Left moving is positive. The value of this attribute applies to the first frame of the Multi-frame image.
angle value 1	(0019,xx01)	DS	1	Positioner angle for L arm in degrees. Movement positive when rotating from RAO to LAO (patient HFS, no table rotation).
angle value 2	(0019,xx02)	DS	1	Positioner angle for Pivot arm in degrees. Movement is positive when rotating from RAO to vertical (patient HFS, no table rotation).
angle value 3	(0019,xx03)	DS	1	Positioner angle for C arm in degrees. Movement is positive when rotating from CAU to vertical (patient HFS, no table rotation).
user zoom factor	(0019,xx18)	IS	1	Zoom factor (integer with no units) applied by the user to the default image displayed.
X zoom	(0019,xx19)	IS	1	row number of the origin of the zoomed area with respect to the origin of the FOV area (starting at 0).
Y zoom	(0019,xx1A)	IS	1	column number of the origin of the zoomed area with respect to the origin of the FOV area (starting at 0).
User spatial filter strength	(0019,xx17)	IS	1	The strength of the spatial filters (no units) selected by the user during the image Review. Values from 1 to 7.

5.3 Private Group GEMS_XR3DCAL_01

Private Group GEMS_XR3DCAL_01 is modeled as part of the Image Information Entity.

Table 4-27: Private Group GEMS_XR3DCAL_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
3Dcal image rows	(0021,xx01)	IS	1	Number of rows of the image of the calibration phantom (helix) that has been used to determine the projection matrices.
3Dcal image columns	(0021,xx02)	IS	1	Number of columns of the image of the calibration phantom (helix) that has been used to determine the projection matrices.
3Dcal field of view	(0021,xx03)	FL	1	Field of View in mm applied to the acquisition of the calibration phantom (helix). Note: the size of the image of the calibration phantom may be bigger than the Field of View region.
3Dcal acquisition date	(0021,xx04)	DA	1	Date of the acquisition of the calibration phantom.
3Dcal acquisition time	(0021,xx05)	TM	1	Time of the acquisition of the calibration phantom.
3Dcal calibration processing date	(0021,xx06)	DA	1	Date of the processing of the calibration that has determined the projection matrices.
3Dcal calibration processing time	(0021,xx07)	TM	1	Time of the processing of the calibration that has determined the projection matrices.
3Dcal L arm angle	(0021,xx08)	FL	1	Mechanical angle of the L-arm (in degrees) corresponding to the first image of the acquisition of the calibration phantom.
3Dcal Pivot angle vector	(0021,xx09)	FL	1-N	Vector of the mechanical angles of the Pivot (in degrees) corresponding to all the images of the acquisition of the calibration phantom. The number of values of this attribute must be equal to the attribute (0021,xx13) "3Dcal number of images".
3Dcal C arm angle	(0021,xx0A)	FL	1	Mechanical angle of the C-arm (in degrees) corresponding to the first image of the acquisition of the calibration phantom.
3Dcal matrix sequence	(0021,xx0B)	SQ	1	Sequence containing the elements of the calibration matrices. The number of items of this sequence must be equal to the attribute (0021,xx13) "3Dcal number of images".
>3Dcal matrix elements	(0021,xx0C)	LO	1-N	Elements of the projection matrices. Each element is a real number represented by a maximum of 5 digits in its integer part, then a comma, then 15 digits in its fractional part.
3Dcal algorithm version	(0021,xx0D)	LO	1	Version of the calibration algorithm.
3Dcal 3D frame unit size	(0021,xx0E)	FL	1	Size in mm of the unity used to describe the 3D frame dimensions.

Attribute Name	Tag	VR	VM	Attribute Description and Use
3Dcal calibration mode	(0021,xx0F)	LO	1	Internal code used to classify the different modes of calibration.
3Dcal image frame origin row	(0021,xx10)	FL	1	Vertical coordinate of the origin of the image frame used for the calculation of the projection matrices, given as row of the calibration image (starts at 0).
3Dcal image frame origin column	(0021,xx11)	FL	1	Horizontal coordinate of the origin of the image frame used for the calculation of the projection matrices, given as column of the calibration image (starts at 0).
3Dcal positioner pivot rotation speed	(0021,xx12)	IS	1	Speed of the pivot rotation, in degrees per second, as specified by the operator before the acquisition of the calibration phantom. Note: this speed may be slightly different from the actual speed of the gantry due to mechanical constraints like acceleration.
3Dcal number of images	(0021,xx13)	IS	1	Number of projections acquired during the acquisition of the calibration phantom.
3Dcal Instance UID	(0021,xx14)	UI	1	SOP Instance UID of the DICOM image corresponding to the acquisition of the calibration phantom.
3Dcal image pixel spacing	(0021,xx15)	FL	2	Distance between the center of each pixel of the image of the calibration phantom, specified by a pair -row spacing value (delimiter) column spacing value in mm.
3Dcal centering mode	(0021,xx16)	CS	1	Type of algorithm that centers the projection matrices: defined values are: "ISOCENTER", "HELIX", "RECTIFIED", "OTHER".
Generalized calibration	(0021,xx20)	LT	1	Augmented calibration string containing the concatenated content of the generalized calibration data.

5.4 Private Group GEMS_DL_IMG_01

Private Group GEMS_DL_IMG_01 is modeled as part of the Image Information Entity.

Table 4-28: Private Group GEMS_DL_IMG_01

Attribute Name	Tag	VR	VM	Attribute Description and Use

Patient position per image	(0019,xxC7)	CS	1	Patient position descriptor relative to the equipment. The defined terms are: • head first = HFP • head first supine = HFS • head first decubitus right = HFDR • head first decubitus left = HFDL • feet first decubitus right = FFDR • feet first decubitus left = FFDL • feet first prone = FFP • feet first supine = FFS
Patient orientation vector	(0019,xxBF)	CS	2–2N	A vector on as many elements as 2 times the number of frames. Each couple of elements contains the Patient Orientation* of the frame. * Patient Orientation as defined in (0020,0020)
Body Part Examined of current Image	(0019,xx70)	CS	1-N	Text description of the part of the body examined of this image
Patient head to end position	(0019,xx71)	FL	1	Tabletop to patient head distance in cm
Internal label	(0019,xx4C)	CS	1	"SEQ"
Calibration sw version	(0019,xx8F)	LO	1	String containing algorithm generation, algorithm version and algorithm release. A new release does not change the algorithm, only change code structure (I/O, code optimization...) [no units].
Image detector rotation angle	(0019,xx92)	DS	1	Image rotation at the detector reading in degrees, before image flip.
image flip	(0019,xx95)	CS	2	Horizontal and vertical image sweep performed by the acquisition system before sending the DICOM image. Defined terms are YES and NO.
Can downscan 512	(0019,xxAA)	CS	1	Indicates the possibility to downscan the pixel data to 512x512 for exchange purposes. Enumerated values : YES/NO.
Table rotation angle	(0019,xxEA)	FL	1	Rotation of the table in the horizontal plane, in degrees. Zero is defined when the head-feet axis of the table is aligned with the CRA-CAU axis of the Isocenter (Z). Positive angles are clockwise when looking at the table from upwards. The valid range is from -180 to +180. Contains the value of the first frame.
Table X Position to Isocenter	(0019,xxEB)	FL	1	X position of the Table Reference Point with respect to the Isocenter (mm). Positive values are towards the LAO direction of the Isocenter. The value of this attribute applies to the first frame of the Multi-frame image.

Table Y Position to Isocenter	(0019,xxEC)	FL	1	Y position of the Table Reference Point with respect to the Isocenter (mm). positive values are downwards the horizontal plane in the vertical direction. The value of this attribute applies to the first frame of the Multi-frame image.
Table Z Position to Isocenter	(0019,xxED)	FL	1	Z position of the Table Reference Point with respect to the Isocenter (mm). Positive values are towards the CRA direction of the Isocenter. The value of this attribute applies to the first frame of the Multi-frame image.
Table head tilt angle	(0019,xxEE)	FL	1	Angle of the head-feet axis of the table in degrees relative to the horizontal plane. Zero is defined when the head-feet axis is in the horizontal plane. Positive values are when the head of the table is upwards the horizontal plane. The valid range is from -45 to +45. Contains the value of the first frame.
Table Head Tilt Angle precision	(0019,xxEF)	FL	1	Precision of the Table Tilt angle expressed as standard deviation in degrees. Contains values equal or higher than zero.
Table cradle angle	(0019,xxBC)	FL	1	Angle of the left-right axis of the table in degrees relative to the horizontal plane. Zero is when the left-right axis is in the horiwontal plane. Positive values are when the left of the table is upwards the horizontal plane. The valid range is from -45 to +45.Contains the value of the first frame.
SID vector	(0019,xxBE)	FL	1-N	Distance in mm from source to detector center for each frame of the multi-frame image.
SOD vector	(0019,xxE9)	FL	1-N	Distance in mm from source to the system isocenter. This is a multi-valued attribute that contains the SOD for each frame.
LV Diastolic contour	(0019,xx0C)	FL	2-2N	Diastolic contour image coordinates. Three or more pairs of values with the coordinates of the contour points [row and column - starting at 1,1] with respect to the origin (upper-left corner) of the pixel data.
LV Systolic contour	(0019,xx0D)	FL	2-2N	Systolic contour image coordinates. Three or more pairs of values with the coordinates of the contour points [row and column - starting at 1,1] with respect to the origin (upper-left corner) of the pixel data.
Default brightness contrast	(0019,xx4E)	DS	2	The brightness/contrast applied during the image acquisition. Brightness from 0.0 to 100.0, Contrast from -100.0 to 100.0.
User brightness contrast	(0019,xx4F)	DS	2	The brightness/contrast modified by the user during the image review. Brightness from 0.0 to 100.0, Contrast from -100.0 to 100.0.
DAP of currect record	(0019,xxE0)	FL	1	XRay dose, measured in dGy*cm*cm, to which the patient was exposed for the acquisition of this image.

auto injection enabled	(0019, xxA4)	CS	1	Enumerated: YES/NO.
injection phase	(0019,xxA5)	CS	1	PRE/POST
injection delay	(0019,xxA6)	DS	1	Number of miliseconds between the injection and the reference frame. Always positive.
reference injection frame number	(0019,xxA7)	IS	1	Frame number of the reference frame related to the auto-injection delay.
recommended display frame rate float	(0019,xxB8)	FL	1	Recommended rate (float) at which the frames of a Multi-frame image should be displayed in frames/second.
fov dimension double	(0019,xx0B)	DS	1-2	Dimensions of the image Intensifier Field of View in mm (double resolution). Value in floating point resolution, whose truncature is (0018,1149). Possible values are: "400\400" OR "320\320" OR "300\300" OR "200\200" OR "172.8\172.8" OR "160\160" OR "147.2\147.2" OR "121.6\121.6"
sensor feedback	(0019,xx9A)	DS	1-N	Internally calculated dose per frame in nGy.
EPT	(0019,xxA9)	DS	1-N	Exposure optimization conditions: equivalent patient thickness in cm. If it contains only one value, it corresponds to the last frame of the multi-frame image. If it contains more than one, it shall contain as many values as frames in the image.
kVp actual vector	(0019,xxAF)	DS	1-N	Exposure conditions (kVp). This is a multi-valued attribute that contains the kVp for each frame.
mAs actual vector	(0019,xxB0)	DS	1-N	Exposure conditions (mAs). This is a multi-valued attribute that contains the mAs for each frame.
Acquisition Mode Description	(0019,xxB1)	LO	1	The precise description of the “numerical code” (Adx acq mode). May be used by the “one touch protocol” editor in AW. (no units).
Acquisition Mode Display Label	(0019,xxB2)	LO	1	Label that shall be displayed on the AW browser, for each sequence (no units).
Acquisition Protocol User Name	(0019,xxB3)	LO	1	Protocol name as it was entered by the user during protocol edit. (no units).
Acquisition Region	(0019,xxBA)	CS	1	Coded String to determine whether the acquisition is Cardiac or Angio. Defined terms are CARDIAC, ANGIO and UNKNOWN.
Acquisition SUB mode	(0019,xxBB)	CS	1	Coded String to determine whether the acquisition mode was designed for a subtracted or Non-subtracted review. Note that this indicates if one or more masks were acquired, which is independent from the fact that the acquisition is reviewed in Sub or No-Sub. Defined terms are SUB, NOSUB and UNKNOWN.

pw actual vector	(0019,xxC2)	DS	1-N	Exposure conditions (pw). This is a multi-valued attribute that contains the pw for each frame.
preselected pivot rotation speed	(0019,xxC5)	FL	1	Speed of the pivot rotation, in degrees per second, as specified by the operator before the acquisition. Values allowed : 10 or 20 or 40 or 16 or 28 deg/sec.
detection gain value	(0019,xxD4)	FL	1	Value in nGy/counts computed at start of acquisition by DIGABD.
mR mAs calibration value	(0019,xxD5)	FL	1	The value of the mR/mAs calibration [no units].
DRM LUT file name	(0019,xxDC)	LO	1	Name of the file where the DRM lookup table can be found. [no units].
DRM Strength	(0019,xxDD)	DS	1-N	DRM Strength [no units].
table rotation status vector	(0019,xxBD)	CS	1-N	Status of the rotation of the table in the horizontal plane for each frame of the multi-frame image. Enumberated values: YES, NO.
table rotation angle increment	(0019,xxC3)	FL	1-N	Incremental change in the rotation of the table in the horizontal plane (clockwise when looking from above the table) relative to the first frame of the Multi-frame image (in degrees). Contains as many values as number of frames. Required if Table Motion is DYNAMIC.
Table X Position to Isocenter increment	(0019,xxD7)	FL	1-N	Incremental change in X position of the Table Reference Point with respect to the Isocenter (in mm), relative to the first frame of the Multi-frame image. Positive values are towards the LAO direction of the Isocenter. Contains as many values as number of frames. Required if Table Motion is DYNAMIC.
Table Y Position to Isocenter increment	(0019,xxD8)	FL	1-N	Incremental change in Y position of the Table Reference Point with respect to the Isocenter (in mm), relative to the first frame of the Multi-frame image. Positive values are downwards the horizontal plane in the vertical direction. Contains as many values as number of frames. Required if Table Motion is DYNAMIC.
Table Z Position to Isocenter increment	(0019,xxD9)	FL	1-N	Incremental change in Z position of the Table Reference Point with respect to the Isocenter (in mm), relative to the first frame of the Multi-frame image. Positive values are towards the CRA direction of the Isocenter. Contains as many values as number of frames. Required if Table Motion is DYNAMIC.
Table Head Tilt Angle increment	(0019,xxDA)	FL	1-N	Vector of increments per frame relative to the first frame of the Table Head Tilt Angle. Contains as many values as number of frames. The first value of the vector is 0.0. Sent if Table Motion is DYNAMIC.

Table Cradle Angle increment	(0019,xxDB)	FL	1-N	Vector of increments per frame relative to the first frame of the Table Cradle Angle.Contains as many values as number of frames.The first value of the vector is 0.0. Required if Table Motion is DYNAMIC.
Table Vertical Position with respect to RIRP	(0019,xx67)	DS	1	Table Top Vertical position with respect to RIRP of the equipment in (mm). Table motion downwards is positive The value of this attribute applies to the first frame of the Multi-frame image.
Table Longitudinal Position with respect to RIRP	(0019,xx68)	DS	1	Table Top Longitudinal position with respect to RIRP of the quipment in (mm). Table motion towards CRA is positive assuming that the patient is positioned supine and its head is in normal position.The value of this attribute applies to the first frame of the Multi-frame image.
Table Lateral Position with respect to RIRP	(0019,xx69)	DS	1	Table Top Lateral position with respect to RIRP of th eequipment in (mm). Table motion towards LAO is positive assuming that the patient is positioned supine and its head is in normal position. The value of this attribute applies to the first frame of the Multi-frame image.
Table Vertical Position with respect to RIRP increment	(0019,xx6A)	DS	1-N	Incremental change in Vertical position of the table relative to RIRP versus first frame of Multi-frame image given in mm. Sent only if Table Motion is equal to DYNAMIC.
Table Longitudinal Position with respect to RIRP increment	(0019,xx6B)	DS	1-N	Incremental change in Longitudinal position of the table relative to RIRP versus first frame of Multi-frame image given in mm. Sent only if Table Motion is equal to DYNAMIC.
Table Lateral Position with respect to RIRP increment	(0019,xx6C)	DS	1-N	Incremental change in Lateral position of the table relative to RIRP versus first frame of Multi-frame image given in mm. Sent only if Table Motion is equal to DYNAMIC.
angle 1 increment	(0019,xx97)	DS	1-N	Incremental change in angle_value_1, sent if positioner motion is dynamic.
angle 2 increment	(0019,xx98)	DS	1-N	Incremental change in angle_value_2, sent if positioner motion is dynamic.
angle 3 increment	(0019,xx99)	DS	1-N	Incremental change in angle_value_3, sent if positioner motion is dynamic.
ISO_x_versus_RIRP	(0019,xx7A)	DS	1	Position in mm of the Frontal (respectively Lateral) Isocenter in the RIRP referential, along the X axis. Positive values are towards the X direction of the Isocenter Coordinate System (LAO direction). The value of this attribute applies to the first frame of the Multi-frame image.
ISO_y_versus_RIRP	(0019,xx7B)	DS	1	Position in mm of the Frontal (respectively Lateral) Isocenter in the RIRP referential, along the Y axis.Positive values are downwards the horizontal plane in the vertical direction. The value of this attribute applies to the first frame of the Multi-frame image.

ISO_z_versus_RIRP	(0019,xx7C)	DS	1	Position in mm of the Frontal (respectively Lateral) Isocenter in the RIRP referential, along the Z axis.Positive values are towards the CRA direction of the Isocenter.The value of this attribute applies to the first frame of the Multi-frame image.
ISO_x_versus_RIRP_incr	(0019,xx7D)	DS	1-N	Increment vector of ISO_x_versus_RIRP versusThe first frame.Sent if positioner motion is dynamic.
ISO_y_versus_RIRP_incr	(0019,xx7E)	DS	1-N	Increment vector of ISO_y_versus_RIRP versusThe first frame.Sent if positioner motion is dynamic.
ISO_z_versus_RIRP_incr	(0019,xx7F)	DS	1-N	Increment vector of ISO_z_versus_RIRP versusThe first frame.Sent if positioner motion is dynamic.
Gantry Trajectory Vector	(0019,xx6D)	CS	1-N	Type of positioner trajectory of each frame. "S" = SWIVEL "P" = PANNING "B" = BACKOUT "O" = PARKING (OUT) "U" = UNKNOWN
applicable review mode	(0019,xx9D)	CS	1	Review mode in which the SUB lut module is applicable. Defined terms re NONE, NAT, SUB and BOTH.
log lut control points	(0019,xx9E)	DS	1-N	Control points of the log LUT.
exp lut SUB control points	(0019,xx9F)	DS	1-N	Control points of the exp LUT for SUB review.
ABD value	(0019,xxA0)	DS	1	Average gray level value of the histogram. Single value that represents the average of all the frames.
sub window center	(0019,xxA1)	DS	1	window center applicable when the SUB lut module is applied.
sub window width	(0019,xxA2)	DS	1	window width applicable when the SUB lut module is applied.
exp lut NOSUB control points	(0019,xxAD)	DS	1-N	Control points of the exp LUT for NOSUB review
ABD Vector	(0019,xxB9)	FL	1-N	Average gray level value of the histogram. Multi-values that contains the value of each single frame.
spectral filter thickness	(0019,xxC4)	IS	1	Thickness of the spectral filter applied to optimize the image quality (in µm)
default spatial filter family	(0019,xx31)	IS	1	The family of the spatial filters applied during the image acquisition.
default spatial filter strength	(0019,xx32)	IS	1	The strength of the spatial filters applied during the image acquisition. Values from 1 to 9.
current spatial filter strength	(0019,xxAB)	IS	1	The strength of the spatial filters selected by the user in DL during the image Review. Values from 1 to 9.
3D structure of interest	(0019,xxC8)	CS	1	Defined terms: VASCULAR, OTHER.
3D calibration out of date flag	(0019,xxC9)	CS	1	Defined terms: YES, NO.

3D spin expected number of frames	(0019,xxCA)	IS	1	Expected number of frames in a 3D spin.
Auto exposure preference	(0019,xx74)	LO	1	Specifies the autoexposure preference that allows selecting between several strategies impacting Dose and Image Quality.
Detail level	(0019,xx75)	LO	1	Specifies the detail level which includes two settings: Low and Normal. There is about 50% less Air Kerma rate in Low versus Normal, except at max Fluoro dose limits.
Dose reduction strategy	(0019,xx76)	LO	1	Specifies the Dose Reduction Strategy that allows selecting between two strategies for reducing dose when lowering fluoro frame rates.

5.5 Private Group GEMS_DL_STUDY_01

Private Group GEMS_DL_STUDY_01 is modeled as part of the Image Information Entity.

Table 4-29: Private Group GEMS_DL_STUDY_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
study number	(0015,xx8F)	IS	1	Internally generated, starting at 1.
study dose	(0015,xx80)	DS	1	Total dose delivered to the patient during the study (in mGy)
study total dap	(0015,xx81)	DS	1	Cumulative dose area product for the study (in cGy.cm2)
study fluoro dap	(0015,xx82)	DS	1	Cumulative dose area product for the fluoro acquisitions performed during the study (in cGy.cm2)
study fluoro time	(0015,xx83)	IS	1	Total time of fluoroscopy during the study (in seconds)
study record dap	(0015,xx84)	DS	1	Cumulative dose area product for the record acquisitions performed during the study (in cGy.cm2)
study record time	(0015,xx85)	IS	1	Total time of record acquisitions during the study (in seconds)
study total fluoro dose	(0015,XXE0)	FL	1	Cumulated fluoro dose under a study
study total record dose	(0015,XXE1)	FL	1	Cumulated record dose under a study

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Chapter 5 SC Information Object Implementation

1 Introduction

This section specifies the use of the DICOM SC Image IOD to represent the information included in SC images produced by this implementation. Corresponding attributes are conveyed using the module construct.

2 Optima Mapping of DICOM Entities

The Optima maps DICOM Information Entities to local Information Entities in the product's database and user interface.

Table 5-1: Mapping of DICOM Entities to Optima Entities

DICOM IE	Optima Entity
Patient	Patient
Study	Exam
Series	Exam
Image	Photo

3 IOD Module Table

The Secondary Capture Information Object Definition comprises the modules of the following table, plus Standard Extended and Private attributes. Standard Extended and Private attributes are described in Section Standard Extended and Private Data Attributes.

Table 5-2: SC Image IOD Modules

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Section 4.1, Patient Entity Modules
	Clinical Trial Subject	NotUsed	N/A
Study	General Study	Used	Section 4.2.1, General Study Module
	Patient Study	Used	Section 4.2.2, Patient Study Module
	Clinical Trial Study	NotUsed	N/A
Series	General Series	Used	Section 4.3, Series Entity Modules
	Clinical Trial Series	N/A	N/A
Equipment	General Equipment	Used	Section 4.4.1, General Equipment Module
	SC Equipment	Used	Section 4.4.2, SC Equipment Module
Image	General Image	Used	Section 4.5.1, General Image Module
	Image Pixel	Used	Section 4.5.2, Image Pixel Module
	Device	Not Used	N/A
	SC Image	Used	Section 4.5.3, SC Image Module
	Overlay Plane	Not Used	N/A
	Modality LUT	Not Used	N/A
	VOI LUT	Used	Section 4.5.4, VOI LUT module
	SOP Common	Used	Section 4.5.5, SOP Common Module

4 Information Module Definitions

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the SC Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

4.1 Patient Entity Modules

Patient Module

Table 5-3: Patient Entity Modules Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	From user interface or worklist. When from user interface, value contains only last_name(restricted to 32 chars)^first_name(restricted to 31 chars). When from worklist, equals first component group.
Patient ID	(0010,0020)	2	From worklist or user interface. Restricted to 64 chars.
Patient's Birth Date	(0010,0030)	2	From user interface or worklist. Restricted to 8 chars. YYYYMMDD
Patient's Sex	(0010,0040)	2	From user interface or worklist. ”M”, ”F” or ”O”.
Other Patient ID	(0010,1000)	3	From Worklist or User interface. Other patient identifier or code
Issuer of Patient ID	(0010,0021)	3	From Worklist. Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID.
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	From Worklist. Attributes specifying or qualifying the identity of the issuer of the Patient ID, or scoping the Patient ID. Only a single Item shall be permitted in this sequence.
> Universal Entity ID	(0040,0032)	3	From Worklist. Universal or unique identifier for the Patient ID Assigning Authority. The authority identified by this attribute shall be the same as that of Issuer of Patient ID (0010,0021), if present.
> Universal Entity ID Type	(0040,0033)	1C	From Worklist. Standard defining the format of the Universal Entity ID (0040,0032). Required if Universal Entity ID (0040,0032) is present.
> Identifier Type Code	(0040,0035)	3	From Worklist. Type of Patient ID.
Other Patient IDs Sequence	(0010,1002)	3	From Worklist. A sequence of identification numbers or codes used to identify the patient. If present, shall contain one or more items.
> Patient ID	(0010,0020)	1	From Worklist. An identification number or code used to identify the patient.

Attribute Name	Tag	Type	Attribute Description
> Issuer of Patient ID	(0010,0021)	1	From Worklist. Identifier of the Assigning Authority (system, organization, agency, or department) that issued the Patient ID.
> Type of Patient ID	(0010,0022)	1	From Worklist. The type of identifier in this item. Defined Terms: TEXT RFID BARCODE

4.2 Study Entity Modules

4.2.1 General Study Module

Table 5-4: General Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	From Worklist. Otherwise, internally generated as follows: "registered prefix for GEMS" + ".2. Registered prefix within GEMS" + ".a.b.c" encoded mac address of the DL host +".x.y.z" unique id protected against reinstallation and re-entrance.
Study Date	(0008,0020)	2	YYYYMMDD, restricted to 8 characters.
Study Time	(0008,0030)	2	HHMMSS.XXX, restricted to 10 characters.
Referring Physician's Name	(0008,0090)	2	Patient's referring physician. From User Interface or worklist, restricted to 64 characters.
Study ID	(0020,0010)	2	From User Interface or Worklist, restricted to 16 characters.
Accession Number	(0008,0050)	2	From User Interface or Worklist, restricted to 16 characters.
Study Description	(0008,1030)	3	Generated description from the Worklist entries for Requested Procedure. If no value found, the value is taken from User Interface
Name of Physician(s) Reading Study	(0008,1060)	3	Physician reading the exam. From User Interface, restricted to 64 characters.
Referenced Study Sequence	(0008,1110)	3	From Worklist. The sequence may have zero or more Items.
>Referenced SOP Class UID	(0008,1150)	1	From Worklist. Required if a sequence item is present.
>Referenced SOP instance UID	(0008,1155)	1	From Worklist. Required if a sequence item is present.

4.2.2 Patient Study Module

Table 5-5: Patient Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Either from User Interface or Calculated from Patient's Birth Date (0010,0030). Three digits followed by one letter: In Years (Y), Months (M), Weeks (W) or Days (D).

Attribute Name	Tag	Type	Attribute Description
Patient's Size	(0010,1020)	3	From User Interface, restricted to 16 characters.
Patient's Weight	(0010,1030)	3	From User Interface, restricted to 16 characters.
Admission ID	(0038,0010)	3	From Worklist, Identification number of the visit as assigned by the healthcare provider

4.3 Series Entity Modules

General Series Module

Table 5-6: General Series Module Attributes

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	"XA"
Series Instance UID	(0020,000E)	1	Unique identifier of the Series. Restricted to 64 characters, internally generated as follows: "registered prefix for GEMS" + ".2. Registered prefix within GEMS" + ".a.b.c" encoded mac address of the DL host +".x.y.z" unique id protected against reinstallation and re-entrance.
Series Number	(0020,0011)	2	A number that identifies this Series. Internally generated, starting at 1.
Series Date	(0008,0021)	3	Date the Series started. YYYYMMDD, restricted to 8 characters.
Series Time	(0008,0031)	3	Time the Series started. HHMMSS.XXX, restricted to 10 characters.
Performing Physicians' Name	(0008,1050)	3	From User Interface, restricted to 64 characters.
Protocol Name	(0018,1030)	3	From User Interface, user defined description of the acquisition protocol
Series Description	(0008,103E)	3	Internally generated Series Description using Study/RP/SPS information
Operator's Name	(0008,1070)	3	From User Interface, restricted to 64 characters.
Body Part Examined	(0018,0015)	3	Text description of the part of the body examined.
Patient Position	(0018,5100)	2C	Patient position descriptor relative to the equipment. Defined terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Request Attributes Sequence	(0040,0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have only one item.

Attribute Name	Tag	Type	Attribute Description
>Requested Procedure ID	(0040,1001)	1C	Identifier that identifies the Requested Procedure in the Imaging Service Request. Required if Sequence Item is present.
>Requested Procedure Description	(0032,1060)	3	Institution-generated administrative description or classification of Requested Procedure. (May not be sent)
>Requested Procedure Code Sequence	(0032,1064)	3	A sequence that conveys the Procedure Type of the requested procedure. The Requested Procedure Code Sequence shall contain only a single item.
>>Code Value	(0008,0100)	1C	Required if a sequence item is present
>>Code schema designator	(0008,0102)	1C	Required if a sequence item is present
>>Code meaning	(0008,0104)	1C	Required if a sequence item is present
>Scheduled Procedure Step ID	(0040,0009)	1C	Identifier that identifies the Scheduled Procedure Step.
>Scheduled Procedure Step Description	(0040,0007)	3	Institution-generated description or classification of the Scheduled Procedure Step to be performed.
>Scheduled Protocol Code Sequence	(0040,0008)	3	Sequence describing the Scheduled Protocol following a specific coding scheme.
>>Code Value	(0008,0100)	1C	Required if a sequence item is present
>>Code schema designator	(0008,0102)	1C	Required if a sequence item is present
>>Code meaning	(0008,0104)	1C	Required if a sequence item is present

4.4 Equipment Entity Modules

4.4.1 General Equipment Module

Table 5-7: General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	"GE MEDICAL SYSTEMS"
Institution Name	(0008,0080)	3	From "Service User Interface", configured at the installation of the system. Restricted to 64 characters
Institution Address	(0008,0081)	3	From "Service User Interface", configured at the installation of the system. Restricted to 1024 characters.
Station Name	(0008,1010)	3	AE-title of the system that created the DICOM image.
Manufacturer's Model Name	(0008,1090)	3	"DL"
Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment. From internal configuration of the machine.
Software Versions	(0018,1020)	3	DL application version.

4.4.2 SC Equipment Module

Table 5-8: SC Equipment Module Attributes

Attribute Name	Tag	Type	Use
Conversion Type	(0008,0064)	1	"WSD"
sc manufacturer	(0018,1016)	3	"GE MEDICAL SYSTEMS"
sc manufacturer model name	(0018,1018)	3	"DL"

4.5 Image Entity Modules

4.5.1 General Image Module

Table 5-9: General Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Internally generated, starting at 1.
Patient Orientation	(0020,0020)	2C	Patient direction of the rows and columns of the image. This attribute contains the values corresponding to the first frame.
Content Date	(0008,0023)	2C	Same as acquisition date (0008,0022)
Content Time	(0008,0033)	2C	Same as acquisition time (0008,0032)
Image Type	(0008,0008)	3	"DERIVED\PRIMARY\SINGLE PLANE" OR "DERIVED\SECONDARY\SINGLE PLANE"
Acquisition Date	(0008,0022)	3	YYYYMMDD, restricted to 8 characters, date the sequence was acquired.
Acquisition Time	(0008,0032)	3	HHMMSS.XXX, restricted to 10 characters, time the sequence was acquired.
Source Image Sequence	(0008,2112)	3	A sequence which identifies the set of Image SOP Class/Instance pairs of the images which were used to derive this image
>referenced frame number	(0008,1160)	3	references one or more frames of a multi-frame image, identifying which frames were used to derive this image
>referenced sop class uid	(0008,1150)	1C	Uniquely identifies the referenced SOP Class
>referenced sop instance uid	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance
Image Comments	(0020,4000)	3	From User Interface, restricted to 64 characters.
Burned In Annotation	(0028,0301)	3	"NO" for Secondary Captures
Derivation Description	(0008,2111)	3	Hardcoded to "Secondary Capture" to indicate that the image is a secondary capture derived from a source image.

4.5.2 Image Pixel Module

Table 5-10: Image Pixel Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	“1”
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Rows	(0028,0010)	1	"1024"
Columns	(0028,0011)	1	"1024"
Bits Allocated	(0028,0100)	1	“8”
Bits Stored	(0028,0101)	1	“8”
High Bit	(0028,0102)	1	“7”
Pixel Representation	(0028,0103)	1	“0”
Pixel Data	(7FE0,0010)	1	Data stream of the pixel samples.

4.5.3 SC Image Module

Table 5-11: SC Image Module Attributes

Attribute Name	Tag	Type	Use
Date of Secondary Capture	(0018,1012)	3	The date the Secondary Capture Image was captured
Time of Secondary Capture	(0018,1014)	3	The time the Secondary Capture Image was captured

4.5.4 VOI LUT module

Table 5-12: VOI LUT module Attributes

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	1C	"128"
Window Width	(0028,1051)	1C	"256"

4.5.5 SOP Common Module

Table 5-13: SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	“1.2.840.10008.5.1.4.1.1.7”
SOP Instance UID	(0008,0018)	1	Restricted to 64 characters, internally generated as follows: "registered prefix for GEMS" + ". 2. Registered prefix within GEMS" + ". a.b.c" encoded mac address of the DL host +". x.y.z" unique id protected against reinstallation and re-entrance.
Specific Character Set	(0008,0005)	1C	"ISO_IR 100"
Instance Number	(0020,0013)	3	Internally generated, starting at 1.

5 Standard Extended and Private Data Attributes

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended SC SOP Instances as Type 3 data elements.

5.1 Standard Attributes

The product supports the following attributes, not specified in the Secondary Capture IOD, in SOP Instances as Type 3 data elements.

Table 5-14: Standard Extented Attributes

Information Entity Name	Attribute Name	Tag	Use
Image	calibration image	(0050,0004)	NO
	KVP	(0018,0060)	Peak kilo voltage output of the Xray generator used
	Table Angle	(0018,1138)	Angle of the head-feet axis of the table in degrees relative to the horizontal plane. Zero is defined when the head-feet axis is in the horizontal plane. Positive values are when the head of the table is upwards the horizontal plane. The valid range is from -45 to +45. Contains the maximum value of all the frames of the multi-frame image
	Distance Source to Patient	(0018,1111)	Internally generated by the acquisition system.
	Distance Source to Detector	(0018,1110)	Internally generated by the acquisition system.
	Positioner Motion	(0018,1500)	DYNAMIC, if Pivot moves or C-ARM moves or L-arm moves or Tilt varies or Table rotation or ISO movement happens. If NO motion [in Pivot or C-arm or Tilt or Table rotation] then it will be sent as STATIC.
	Positioner Primary Angle	(0018,1510)	Position of the Xray Image Intensifier about the patient from the RAO to LAO direction where movement from RAO to vertical is positive. For multi-frame images, value of the first frame. Note: The values correspond to the motions in Pivot, C, L-arm, Rotation, Tilt, Patient Position
	Positioner Secondary Angle	(0018,1511)	Position of the Xray Image Intensifier about the patient from the CAU to CRA direction where movement from CAU to vertical is positive. For multi-frame images, value of the first frame. Note: The values correspond to the motions in Pivot, C, L-arm, Rotation, Tilt, Patient Position

Information Entity Name	Attribute Name	Tag	Use
	field of view dimension(s)	(0018,1149)	From user selection in the User Interface of the acquisition system. Possible values are "400\400" OR "320\320" OR "300\300" OR "200\200" OR "172\172" OR "170\170" OR "160\160" OR "150\150" OR "147\147" OR "121\121" OR "120\120"

5.2 Private Group DLX_SERIE_01

Private Group Private Group DLX_SERIE_01 is modeled as part of the Image Information Entity.

Table 5-15: Private Group DLX_SERIE_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
Slope LV regression	(0019,xx25)	DS	1	Slope coefficient (unit less) of the linear regression correction of the Left Ventricular volume. This linear regression corrects the Left Ventricular volume calculated by the Dodge's method from the contour of the left ventricle traced by an expert.
Intercept LV regression	(0019,xx26)	DS	1	Intercept coefficient (in cm3) of the linear regression correction of the Left Ventricular volume. This linear regression corrects the Left Ventricular volume calculated by the Dodge's method from the contour of the left ventricle traced by an expert.
table vertical position	(0019,xx21)	DS	1	Absolute Vertical position of the table (in mm) with respect to the table referential. Down moving is positive. The value of this attribute applies to the first frame of the Multi-frame image.
table longitudinal position	(0019,xx22)	DS	1	Absolute Longitudinal position of the table (in mm) with respect to the table referential. Head moving is positive. The value of this attribute applies to the first frame of the Multi-frame image.
table lateral position	(0019,xx23)	DS	1	Absolute Lateral position (in mm) of the table with respect to the table referential. Left moving is positive. The value of this attribute applies to the first frame of the Multi-frame image.
angle value 1	(0019,xx01)	DS	1	Positioner angle for L arm in degrees. Movement positive when rotating from RAO to LAO (patient HFS, no table rotation)
angle value 2	(0019,xx02)	DS	1	Positioner angle for Pivot arm in degrees. Movement is positive when rotating from RAO to vertical (patient HFS, no table rotation)
angle value 3	(0019,xx03)	DS	1	Positioner angle for C arm in degrees. Movement is positive when rotating from CAU to vertical (patient HFS, no table rotation)

5.3 Private Group GEMS_DL_IMG_01

Private Group Private Group GEMS_DL_IMG_01is modeled as part of the Image Information Entity.

Table 5-16: Private Group GEMS_DL_IMG_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
source series number	(0019,xx50)	IS	1	number of the source series for a photo [no units].
source image number	(0019,xx51)	IS	1	number of the source image for a photo [no units].
source frame number	(0019,xx52)	IS	1	Frame number of original image [no units]
patient position per image	(0019,xxC7)	CS	1	Patient position descriptor relative to the equipment. The defined terms are: • head first-prone= HFP • head first supine = HFS • head first decubitus right = HFDR • head first decubitus left = HFDL • feet first decubitus right = FFDR • feet first decubitus left = FFDL • feet first-Prone = FFP • feet first-Supine = FFS
Body Part Examined of current Image	(0019,xx70)	CS	1-N	Text description of the part of the body examined of this image
Patient head to end position	(0019,xx71)	FL	1	Tabletop to patient head distance in cm
internal label	(0019,xx4C)	CS	1	PHOTO
calibration frame	(0019,xx81)	US	1	frame on which the calibration was performed
calibration object	(0019,xx82)	CS	1	Enumerated: sphere, catheter or segment (only one)
calibration object size mm	(0019,xx83)	DS	1	size (diameter, distance...) in mm
calibration factor	(0019, xx84)	FL	1	calib factor in mm/pix
calibration date	(0019,xx85)	DA	1	Date of the calibration of the image
calibration time	(0019,xx86)	TM	1	Time of the calibration of the image
calibration accuracy	(0019,xx87)	US	1	in % with respect to the calibration factor
calibration extended	(0019,xx88)	CS	1	Enumerated: YES/NO
calibration image original	(0019,xx89)	US	1	if extended calibration, the image number of the original calibration.
calibration frame original	(0019,xx8A)	US	1	if extended calibration, the frame number of the original calibration.
calibration number of points uif	(0019,xx8B)	US	1	0,1 or 2 [no units]

Attribute Name	Tag	VR	VM	Attribute Description and Use
calibration points row	(0019,xx8C)	US	1-2	Location of the points that define the calibration object, given as row
calibration points column	(0019,xx8D)	US	1-2	Location of the points that define the calibration object, given as column
calibration magnification ratio	(0019,xx8E)	FL	1	Ratio between the SID over the distance from source to the center of the calibration object (> 1.0) [no units]
calibration sw version	(0019,xx8F)	LO	1	String containing algorithm generation, algorithm version and algorithm release. A new release does not change the algorithm, only change code structure (I/O, code optimization...) [no units]
extend calibration sw version	(0019,xx90)	LO	1	String containing algorithm generation, algorithm version and algorithm release. A new release does not change the algorithm, only change code structure (I/O, code optimization...) [no units]
calibration return code	(0019,xx91)	IS	1	code returned by the calibration algorithm [no units]
Distance Object to Table Top	(0019,xx2B)	FL	1	Distance between the object of observation and table top in mm
image detector rotation angle	(0019,xx92)	DS	1	Image rotation at the detector reading in degrees, before image flip.
image flip	(0019,xx95)	CS	2	Horizontal and vertical image sweep performed by the acquisition system before sending the DICOM image. Defined terms are YES and NO.
can downscan 512	(0019,xxAA)	CS	1	Indicates the possibility to downscan the pixel data to 512x512 for exchange purposes. Enumerated values : YES/NO
table rotation angle	(0019,xxEA)	FL	1	Rotation of the table in the horizontal plane, in degrees. Zero is defined when the head-feet axis of the table is aligned with the CRA-CAU axis of the Isocenter (Z). Positive angles are clockwise when looking at the table from upwards. The valid range is from -180 to +180. Contains the value of the first frame.
Table X Position to Isocenter	(0019,xxEB)	FL	1	X position of the Table Reference Point with respect to the Isocenter (mm). Positive values are towards the LAO direction of the Isocenter. The value of this attribute applies to the first frame of the Multi-frame image.
Table Y Position to Isocenter	(0019,xxEC)	FL	1	Y position of the Table Reference Point with respect to the Isocenter (mm). positive values are downwards the horizontal plane in the vertical direction. The value of this attribute applies to the first frame of the Multi-frame image.

Attribute Name	Tag	VR	VM	Attribute Description and Use
Table Z Position to Isocenter	(0019,xxED)	FL	1	Z position of the Table Reference Point with respect to the Isocenter (mm). Positive values are towards the CRA direction of the Isocenter. The value of this attribute applies to the first frame of the Multi-frame image.
table head tilt angle	(0019,xxEE)	FL	1	Angle of the head-feet axis of the table in degrees relative to the horizontal plane. Zero is defined when the head-feet axis is in the horizontal plane. Positive values are when the head of the table is upwards the horizontal plane. The valid range is from -45 to +45. Contains the value of the first frame.
Table Head Tilt Angle precision	(0019,xxEF)	FL	1	Precision of the Table Tilt angle expressed as standard deviation in degrees. Contains values equal or higher than zero.
table cradle angle	(0019,xxBC)	FL	1	Angle of the left-right axis of the table in degrees relative to the horizontal plane. Zero is when the left-right axis is in the horizontal plane. Positive values are when the left of the table is upwards the horizontal plane. The valid range is from -45 to +45.Contains the value of the first frame.
SID vector	(0019,xxBE)	FL	1-N	Distance in mm from source to detector center for each frame of the multi-frame image.
SOD vector	(0019,xxE9)	FL	1-N	Distance in mm from source to the system isocenter. This is a multi-valued attribute that contains the SOD for each frame
LV Diastolic contour	(0019,xx0C)	FL	2-2N	Diastolic contour image coordinates. Three or more pairs of values with the coordinates of the contour points [row and column - starting at 1,1] with respect to the origin (upper-left corner) of the pixel data.
LV Systolic contour	(0019,xx0D)	FL	2-2N	Systolic contour image coordinates. Three or more pairs of values with the coordinates of the contour points [row and column - starting at 1,1] with respect to the origin (upper-left corner) of the pixel data.
default brightness contrast	(0019,xx4E)	DS	2	The brightness/contrast applied during the image acquisition. Brightness from 0.0 to 100.0, Contrast from -100.0 to 100.0
user brightness contrast	(0019,xx4F)	DS	2	The brightness/contrast modified by the user during the image review. Brightness from 0.0 to 100.0, Contrast from -100.0 to 100.0
Table Vertical Position with respect to RIRP	(0019,xx67)	DS	1	Incremental change in Vertical position of the table relative to RIRP versus first frame of Multi-frame image given in mm. Sent only if Table Motion is equal to DYNAMIC.
Table Longitudinal Position with respect to RIRP	(0019,xx68)	DS	1	Incremental change in Longitudinal position of the table relative to RIRP versus first frame of Multi-frame image given in mm. Sent only if Table Motion is equal to DYNAMIC.

Attribute Name	Tag	VR	VM	Attribute Description and Use
Table Lateral Position with respect to RIRP	(0019,xx69)	DS	1	Incremental change in Lateral position of the table relative to RIRP versus first frame of Multi-frame image given in mm. Sent only if Table Motion is equal to DYNAMIC.

5.4 Private Group GEMS_DL_STUDY_01

Private Group Private Group GEMS_DL_STUDY_01 is modeled as part of the Image Information Entity.

Table 5-17: Private Group GEMS_DL_STUDY_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
study number	(0015,xx8F)	IS	1	Internally generated, starting at 1.
study dose	(0015,xx80)	DS	1	Total dose delivered to the patient during the study (in mGy)
study total dap	(0015,xx81)	DS	1	Cumulative dose area product for the study (in cGy.cm2)
study fluoro dap	(0015,xx82)	DS	1	Cumulative dose area product for the fluoro acquisitions performed during the study (in cGy.cm2)
study fluoro time	(0015,xx83)	IS	1	Total time of fluoroscopy during the study (in seconds)
study record dap	(0015,xx84)	DS	1	Cumulative dose area product for the record acquisitions performed during the study (in cGy.cm2)
study record time	(0015,xx85)	IS	1	Total time of record acquisitions during the study (in seconds)
study total fluoro dose	(0015,XXE0)	FL	1	Cumulated fluoro dose under a study
study total record dose	(0015,XXE1)	FL	1	Cumulated record dose under a study

5.5 Private Group GEMS_QVA_PHOTO_01

Private Group Private Group GEMS_QVA_PHOTO_01 modeled as part of the Image Information Entity.

Table 5-18: Private Group GEMS_QVA_PHOTO_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
Dodge End Diastolic Volume ml	(0009,xx60)	FL	1	Dodge's End Diastolic Volume ml
Dodge End Systolic Volume ml	(0009,xx61)	FL	1	Dodge's End Systolic Volume ml
Dodge Stroke Volume ml	(0009,xx62)	FL	1	Dodge's Stroke Volume ml
Dodge Ejection Fraction	(0009,xx63)	IS	1	Dodge's Ejection Fraction [in percent 0..100]
Simpson's End Diastolic Volume ml	(0009,xx64)	FL	1	Simpson's End Diastolic Volume ml
Simpson End Systolic Volume ml	(0009,xx65)	FL	1	Simpson's End Systolic Volume ml
Simspon's Stroke Volume ml	(0009,xx66)	FL	1	Simspon's Stroke Volume ml

Attribute Name	Tag	VR	VM	Attribute Description and Use
Simpson Ejection Fraction	(0009,xx67)	IS	1	Simspon's Ejection Fraction [in percent 0 .. 100]
CFX Single Hypokinesia in Region	(0009,xx68)	FL	1	CFX Single Hypokinesia in Region
CFX Single Hyperkinesia in Opposite Region	(0009,xx69)	FL	1	CFX Single Hyperkinesia in Opposite Region
CFX Single Total LV contour Percent	(0009,xx6A)	IS	1	CFX Single Total LV contour Percent
CFX Multiple Hypokinesia in Region	(0009,xx6B)	FL	1	CFX Multiple Hypokinesia in Region
CFX Multiple Hyperkinesia in Opposite Region	(0009,xx6C)	FL	1	CFX Multiple Hyperkinesia in Opposite Region
CFX Multiple Total LV contour Percent	(0009,xx6D)	IS	1	CFX Multiple Total LV contour Percent
RCA Single Hypokinesia in Region	(0009,xx6E)	FL	1	RCA Single Hypokinesia in Region
RCA Single Hyperkinesia in Opposite Region	(0009,xx6F)	FL	1	RCA Single Hyperkinesia in Opposite Region
RCA Single Total LV contour Percent	(0009,xx70)	IS	1	RCA Single Total LV contour Percent
RCA Multiple Hypokinesia in Region	(0009,xx71)	FL	1	RCA Multiple Hypokinesia in Region
RCA Multiple Hyperkinesia in Opposite Region	(0009,xx72)	FL	1	RCA Multiple Hyperkinesia in Opposite Region
RCA Multiple Total LV contour Percent	(0009,xx73)	IS	1	RCA Multiple Total LV contour Percent
LAD Single Hypokinesia in Region	(0009,xx74)	FL	1	LAD Single Hypokinesia in Region
LAD Single Hyperkinesia in Opposite Region	(0009,xx75)	FL	1	LAD Single Hyperkinesia in Opposite Region
LAD Single Total LV contour Percent	(0009,xx76)	IS	1	LAD Single Total LV contour Percent
LAD Multiple Hypokinesia in Region	(0009,xx77)	FL	1	LAD Multiple Hypokinesia in Region
LAD Multiple Hyperkinesia in Opposite Region	(0009,xx78)	FL	1	LAD Multiple Hyperkinesia in Opposite Region
LAD Multiple Total LV contour Percent	(0009,xx79)	IS	1	LAD Multiple Total LV contour Percent
Dodge End Diastolic Volume ml/m2	(0009,xx7A)	FL	1	Dodge's End Diastolic Volume ml/m2
Dodge End Systolic Volume ml/m2	(0009,xx7C)	FL	1	Dodge's End Systolic Volume ml/m2
Dodge Stroke Volume ml/m2	(0009,xx7E)	FL	1	Dodge's Stroke Volume ml/m2
Simpson End Diastolic Volume ml/m2	(0009,xx80)	FL	1	Simspon's End Diastolic Volume ml/m2
Simpson End Systolic Volume ml/m2	(0009,xx82)	FL	1	Simspon's End Systolic Volume ml/m2
Simpson’s Stroke Volume ml/m2	(0009,xx84)	FL	1	Simspon's Stroke Volume ml/m2

5.6 Private Group QCA_RESULTS

Private Group Private Group QCA_RESULTS modeled as part of the Image Information Entity.

Table 5-19: Private Group QCA_RESULTS

Attribute Name	Tag	VR	VM	Attribute Description and Use
Analysis Views	(0009,xx00)	CS	1	Enumerated type containing one of the following values: PRE, POST and PRE_POST.

Attribute Name	Tag	VR	VM	Attribute Description and Use
Segment	(0009,xx10)	LO	1	ACC segment name. Defined terms: Proximal RCARCA OstiumMid RCADistal RCARight PDARight LV-BRLMCALMCA OstiumProximal LADMid LAD Distal LAD1st Diagonal2nd Diagonal1st Septal-Proximal CircumflexMid Circumflex1st Marginal2nd Marginal3rd Marginal Distal CircumflexL
Pre Catheter Name	(0009,xx11)	LO	1	User description of pre-procedure catheter. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST"
Pre Catheter Size	(0009,xx12)	DS	1	Size of pre-procedure catheter in millimeters. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST".
Pre Reference Diameter	(0009,xx13)	DS	1	Pre-procedure Reference Diameter, in millimeters. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST".
Pre Minimum Lumen Diameter	(0009,xx14)	DS	1	Pre-procedure Minimum Lumen Diameter, in millimeters. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST".
Pre Average Diameter	(0009,xx15)	DS	1	Pre-procedure Average Diameter, in millimeters. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST".
Pre Stenosis Length	(0009,xx16)	DS	1	Pre-procedure Stenosis Length, in millimeters. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST".
Pre Stenosis %	(0009,xx17)	IS	1	Pre-procedure Stenosis as a percentage. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST".
Pre Geometric Area Reduction %	(0009,xx18)	IS	1	Pre-procedure Geometric Area Reduction as a percentage. Required if Analysis Type (0009,1100) is "PRE" or "PRE_POST".
Post Catheter Name	(0009,xx21)	LO	1	User description of post-procedure catheter. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".
Post Catheter Size	(0009,xx22)	DS	1	Size of post-procedure catheter in millimeters. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".
Post Reference Diameter	(0009,xx23)	DS	1	Post-procedure Reference Diameter, in millimeters. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".
Post Minimum Lumen Diameter	(0009,xx24)	DS	1	Post-procedure Minimum Lumen Diameter, in millimeters. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".
Post Average Diameter	(0009,xx25)	DS	1	Post-procedure Average Diameter, in millimeters. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".
Post Stenosis Length	(0009,xx26)	DS	1	Post-procedure Stenosis Length, in millimeters. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".

Attribute Name	Tag	VR	VM	Attribute Description and Use
Post Stenosis %	(0009,xx27)	IS	1	Post-procedure Stenosis as a percentage. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".
Post Geometric Area Reduction %	(0009,xx28)	IS	1	Post-procedure Geometric Area Reduction as a percentage. Required if Analysis Type (0009,1100) is "POST" or "PRE_POST".

5.7 Private Group QUANTITATIVE_RESULTS

Private Group Private Group QUANTITATIVE_RESULTS modeled as part of the Image Information Entity.

Table 5-20: Private Group QUANTITATIVE_RESULTS

Attribute Name	Tag	VR	VM	Attribute Description and Use
Calibration Frame	(0009,xx40)	IS	1	Frame in this image used for calibration; no value if image was not calibrated or calibration was extended from another image
End Diastolic Frame	(0009,xx41)	IS	1	Frame number of the end-diastolic frame used in the analysis
End Systolic Frame	(0009,xx42)	IS	1	Frame number of the end-systolic frame used in the analysis
End Diastolic Volume	(0009,xx43)	DS	1	End Diastolic Volume, given in cubic centimeters.
End Systolic Volume	(0009,xx44)	DS	1	End Systolic Volume, given in cubic centimeters.
Stroke Volume	(0009,xx45)	DS	1	Stroke Volume, given in cubic centimeters.
Cardiac Output	(0009,xx46)	DS	1	Cardiac Output, given in liters per minute.
Ejection Fraction	(0009,xx47)	DS	1	Ejection Fraction expressed as a percentage.
Body Surface Area	(0009,xx48)	DS	1	Body Surface Area, given in square meters.
Artery Territory Region	(0009,xx49)	SH	1	Region of interest as selected by the user. Defined terms:{RCA, LAD, CFX}
Number of Diseased Vessels	(0009,xx50)	IS	1	The number of diseased vessels in the region of interest, as selected by the user.
Hypokinesis in Region	(0009,xx51)	DS	1	The amount of hypokinetic wall motion in the region of interest, in standard deviations
Hyperkinesis in Opposite Region	(0009,xx52)	DS	1	The amount of hyperkinetic wall motion in the region opposite the region of interest, in standard deviations
Percent Total LV Hypokinesis	(0009,xx53)	IS	1	Percentage of chords in the total LV contour which are hypokinetic by more than 2 standard deviations
Calibration Factor	(0009,xx55)	DS	1	Millimeter per pixel

Chapter 6 Modality Worklist Information Model Definition

1 Introduction

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed.

2 Optima Mapping of DICOM Entities

The Optima maps DICOM Information Entities to local Information Entities in the product's database and user interface.

Table 6-1: Mapping of DICOM Entities to Optima Entities

DICOM	Optima Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Exam
Patient	Patient

3 Worklist Query Module Table

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

Table 6-2: Modality Worklist Information Model Modules

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	Section 4.1.1, SOP Common Module
	Scheduled Procedure Step	Section 4.1.2, Scheduled Procedure Step Module
Requested Procedure	Requested Procedure	Section 4.2, Common Requested Procedure Entity Modules
Imaging Service Request	Imaging Service Request	Section 4.3, Common Imaging Service Request Entity Modules
Visit	Visit Identification	Section 4.4, Common visit Entity Modules
	Visit Status	Not Used
	Visit Relationship	Not Used
	Visit Admission	Not Used
Patient	Patient Relationship	Not Used
	Patient Identification	Section 4.5.1, Patient Identification
	Patient Demographic	Section 4.5.2, Patient Demographic
	Patient Medical	Not Used

4 Worklist Query Module Definitions

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) for a description of each of the query key attributes contained within the Modality Worklist Information Model.

4.1 Common Scheduled Procedure Step Entity Modules

4.1.1 SOP Common Module

Table 6-3: SOP Common Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
Specific Character Set	(0008,0005)	O	1C	No/No	Matching on this tag is not supported. ISO_IR 100 or ISO_IR 6 is only accepted. The default value if either not present or sent as EMPTY shall be considered as ISO_IR 6 Multi valued character set is supported provided the first character set value is either EMPTY or ISO 2022 IR 6 or ISO 2022 IR 100

4.1.2 Scheduled Procedure Step Module

Table 6-4: Scheduled Procedure Step Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No/No	
>Scheduled Station AE Title	(0040,0001)	R	1	No/No	Matching is supported. The matching value is the AE– Title of the Optima system.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1 *	No/No	Matching value can be configured for date or date range.
>Scheduled Procedure Step Start Time	(0040,0003)	R	1 *	No/No	Requested, zero length.
>Modality	(0008,0060)	R	1	No/No	Matching is supported. This is requested either as zero length or as XA, user configurable.
>Scheduled Performing Physician's Name	(0040,0006)	R	2	No/No	Requested, zero length. After user confirmation, the first value can be mapped into Performing Physician (0008, 1050).
>Scheduled Procedure Step Description	(0040,0007)	O	1C *	Yes/Yes	
>Scheduled Protocol Code Sequence	(0040,0008)	O	1C	Yes/Yes	

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
>>Code Value	(0008,0100)	O	1	Yes/Yes	
>>Coding Scheme Designator	(0008,0102)	O	1	Yes/Yes	
>>Code Meaning	(0008,0104)	O	3	Yes/Yes	
>Scheduled Procedure Step ID	(0040,0009)	O	1 *	Yes/Yes	

NOTE: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

4.2 Common Requested Procedure Entity Modules

Requested Procedure Module

Table 6-5: Requested Procedure Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
Requested Procedure ID	(0040,1001)	O	1 *	Yes/Yes	Single Value or Wild card matching is supported for this data element. Requested, zero length. This information can be mapped into Study ID (0020,0010) after user confirmation.
Requested Procedure Description	(0032,1060)	O	1C *	Yes/Yes	Requested, zero length.
Requested Procedure Code Sequence	(0032,1064)	O	1C	Yes/Yes	
>Code Value	(0008,0100)	O	1	Yes/Yes	
>Coding Scheme Designator	(0008,0102)	O	1	Yes/Yes	
>Code Meaning	(0008,0104)	O	3	Yes/Yes	
Study Instance UID	(0020,000D)	O	1	Yes/Yes	
Referenced Study Sequence	(0008,1110)	O	2	Yes/Yes	
>Referenced SOP Class UID	(0008,1150)	O	1C	Yes/Yes	
>Referenced SOP Instance UID	(0008,1155)	O	1C	Yes/Yes	

NOTE: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

4.3 Common Imaging Service Request Entity Modules

Imaging Service Request Module

Table 6-6: Imaging Service Request Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
Accession Number	(0008,0050)	O	2 *	Yes/Yes	Single Value or Wild char matching is supported, user entered value is sent.
Referring Physician's Name	(0008,0090)	O	2 *	Yes/No	Requested, zero length. The first person name component group is mapped in the image. No truncation is performed. Values may be truncated for display only.

NOTE: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

4.4 Common visit Entity Modules

Visit Identification

Table 6-7: Visit Identification Module Attribute

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
Admission ID	(0038,0010)	O	2	Yes/No	Requested, zero length.

4.5 Common Patient Entity Modules

4.5.1 Patient Identification

Table 6-8: Patient Identification Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
Patient's Name	(0010,0010)	R	1 *	Yes/Yes	Matching is supported, user entered value is sent. Wild-cards are appended in the query at the end of the components (first name and last name). The first person name component group returned is mapped in the image. No truncation is performed. Values may be truncated for display only.
Patient ID	(0010,0020)	R	1 *	Yes/Yes	Matching is supported, user entered value is sent.
Other Patient ID	(0010,1000)	O	3	Yes/No	Requested, zero length
Issuer of Patient ID	(0010, 0021)	O	3	Yes/Yes	Requested, zero length
Issuer of Patient ID Qualifiers Sequence	(0010, 0024)	O	3	Yes/Yes	Requested, zero length

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
> Universal Entity ID	(0040,0032)	O	3	Yes/Yes	Requested, zero length
> Universal Entity ID Type	(0040,0033)	O	3	Yes/Yes	Requested, zero length
> Identifier Type Code	(0040,0035)	O	3	Yes/Yes	Requested, zero length
Other Patient IDs Sequence	(0010, 1002)	O	3	Yes/Yes	Requested, zero length
> Patient ID	(0010,0020)	O	3	Yes/No	Requested, zero length
> Issuer of Patient ID	(0010,0021)	O	3	Yes/No	Requested, zero length
> Type of Patient ID	(0010,0022)	O	3	Yes/No	Requested, zero length
Patient State	(0038,0500)	O	2	No/No	Requested, zero length
Pregnancy Status	(0010,21C0)	O	2	No/No	Requested, zero length
Medical Alerts	(0010,2000)	O	2	No/No	Requested, zero length
Allergies	(0010,2110)	O	2	No/No	Requested, zero length
Special Needs	(0038,0050)	O	2	No/No	Requested, zero length

NOTE: * in the *Expected Return Key* Type column indicates that this information is displayed on screen, if available.

4.5.2 Patient Demographic

Table 6-9: Patient Demographic Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image / MPPS	Note
Patients Birth Date	(0010,0030)	O	2 *	Yes/Yes	Requested, zero length.
Patient’s Sex	(0010,0040)	O	2 *	Yes/Yes	Requested, zero length.
Patient’s Weight	(0010,1030)	O	2 *	Yes/No	Requested, zero length.
Patient’s Size	(0010,1020)	O	3 *	Yes/No	Requested, zero length.

NOTE: * in the *Expected Return Key Type* column indicates that this information is displayed on screen, if available.

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Chapter 7 Storage Commitment Push Model Implementation

1 Storage Commitment Push Model Implementation

1.1 Storage commitment push model implementation

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the attributes contained within the Storage Commitment Information Object.

The Storage Commitment Information Object is used both for N-ACTION Storage Commitment Requests by the SCU and N-EVENT-REPORT Storage Commitment Notifications by the SCP.

1.2 Storage Commitment Module for N-Action

Table 7-1: Storage Commitment Module for N-Action-RQ

Attribute Name	Tag	AE Use
Transaction UID	(0008,1195)	
Storage Media File–Set ID	(0088,0130)	Not used
Storage Media File–Set UID	(0088,0140)	Not used
Referenced SOP Sequence	(0008,1199)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
>Storage Media File–Set ID	(0088,0130)	Not used
>Storage Media File–Set UID	(0088,0140)	Not used

1.3 Storage Commitment Module for N-Event-Report

Table 7-2: Storage Commitment Module for N-Event-Report

Attribute Name	Tag	AE Use
Transaction UID	(0008,1195)	
Retrieve AE Title	(0008,0054)	Not used
Storage Media File–Set ID	(0088,0130)	Not used
Storage Media File–Set UID	(0088,0140)	Not used
Referenced SOP Sequence	(0008,1199)	The AE considers the SOP Instances referenced by this sequence as successfully archived.
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
>Retrieve AE Title	(0008,0054)	Not used
>Storage Media File–Set ID	(0088,0130)	Not used
>Storage Media File–Set UID	(0088,0140)	Not used

Attribute Name	Tag	AE Use
Failed SOP Sequence	(0008,1198)	The AE considers the SOP Instances referenced by this sequence as not archived; the application will display an error status in the network queue.
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	
>Failure Reason	(0008,1197)	See Table 7-3 for the range of possible values.

Processing of Failure Reason when received in a N-Event-Report

When receiving a N-Event-Report request with a Event Type ID equal to 2, meaning that Storage Commitment is complete, but failure exists, following is the set of value that this Storage Commitment SCU AE is able to process:

Table 7-3: Storage Commitment Module for N-Event-Report

Failure Reason	Meaning	Application Behavior When Receiving Reason Code
0110H	Processing failure	Display error status in network queue.
0112H	No such object instance	Display error status in network queue.
0213H	Resource limitation	Display error status in network queue.
0122H	Referenced SOP Class not supported	Display error status in network queue.
0119H	Class / Instance conflict	Display error status in network queue.
0131H	Duplicate transaction UID	Display error status in network queue.
*	Other Failure Reason code values	Display error status in network queue.

Chapter 8 Modality Performed Procedure Step Implementation

1 Introduction

This section specifies the use of the DICOM Modality Performed Procedure Step information to be communicated to the Hospital/Radiology information system.

This feature works in conjunction with DICOM Modality Worklist feature, if installed. However the conformance of this feature is independent of Modality Worklist feature. For information on conformance of Modality Worklist feature to DICOM standard please refer to the appropriate section in this document.

2 Relationship Between Scheduled and Performed Procedure Steps

Optima supports the following relationships between Scheduled Procedure Step and PPS:

- One-to-one (aka Simple Case).
- One-to-multiple (aka Append Case).
- Zero-to-one (aka Unscheduled Case or Acquisition without MWL Data).
- Zero-to-multiple (aka Append for Unscheduled case).

NOTE: Multiple-to-one relationship (aka Group Case) is not supported.

3 Modality Performed Procedure Step Module Table

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

Table 8-1:

Module	Reference
SOP Common Module	Section 4.1, SOP Common Module
Performed Procedure Step Relationship Module	Section 4.2, Performed Procedure Step Relationship Module
Performed Procedure Step Information Module	Section 4.3, Performed Procedure Step Information Module
Image Acquisition Result Module	Section 4.4, Image Acquisition Result Module
Radiation Dose Module	Section 4.5, Radiation Dose Module
Billing and Material Management Codes Module	Not Used

4 Modality Performed Procedure Step Module Definitions

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) for a description of each of the attributes contained within the Modality Performed Procedure Step Information Object Definition.

4.1 SOP Common Module

Table 8-2: SOP Common Module Attributes

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Specific Character Set	(0008,0005)	1C	-	ISO_IR 100

4.2 Performed Procedure Step Relationship Module

Table 8-3: Performed Procedure Step Relationship Module Attributes

Attribute Name	Tag	Type for SCU - N-CREATE	
		Acquisition without MWL Entry	Acquisition with MWL Entry
Scheduled Step Attributes Sequence	(0040,0270)	1, Has only one item	1, Has only one item
>Study Instance UID	(0020,000D)	1, value is internally generated	1, filled from worklist
>Referenced Study Sequence	(0008,1110)	2, Sent EMPTY	For scheduled cases, the value comes from Worklist. If Not available in Worklist, SOP Class UID (0008,1150) filled with the value 1.2.840.10008.3.1.2.3.1 and A SOP Instance UID (0008,1155) filled with value stored in Study Instance UID (0020,000D).
>>Referenced SOP Class UID	(0008,1150)	1, Not Sent	1, filled from worklist. If not available, filled with value “1.2.840.10008.3.1.2.3.1”
>>Referenced SOP Instance UID	(0008,1155)	1, Not Sent	1, filled from worklist. If not available, filled with study instance UID (0020,000D)
>Accession Number	(0008,0050)	2, Sent EMPTY	2, filled from Worklist. Can be updated through User Interface.
>Requested Procedure ID	(0040,1001)	2, Sent Empty	2, From Worklist
>Requested Procedure Code Sequence	(0032,1064)	3, Not Sent	3, From Worklist
>>Code Value	(0008,0100)	1, Not Sent	1, From Worklist. Sent if the Sequence is not Empty.
>>Coding Scheme Designator	(0008,0102)	1, Not Sent	1, From Worklist. Sent if the Sequence is not Empty.
>>Code Meaning	(0008,0104)	1, Not Sent	1, From Worklist. Sent if the Sequence is not Empty.

Attribute Name	Tag	Type for SCU - N-CREATE	
		Acquisition without MWL Entry	Acquisition with MWL Entry
>Requested Procedure Description	(0032,1060)	2, Sent Empty	2, From Worklist.
>Scheduled Procedure Step ID	(0040,0009)	2, Sent Empty	2, From Worklist.
>Scheduled Procedure Step Description	(0040,0007)	2, Sent Empty	2, From Worklist.
>Scheduled Protocol Code Sequence	(0040,0008)	2, Sent Empty	2, From Worklist.
>>Code Value	(0008,0100)	1, Not Sent	1, From Worklist. Sent if the Sequence is not Empty.
>>Coding Scheme Designator	(0008,0102)	1, Not Sent	1, From Worklist. Sent if the Sequence is not Empty.
>>Code Meaning	(0008,0104)	3, Not Sent	3, From Worklist. Sent if the Sequence is not Empty
Patient's name	(0010,0010)	2, filled from User Interface	2, From Worklist or User Interface
Patient ID	(0010,0020)	2, filled from User Interface	2, From Worklist or User Interface
Patient's birth date	(0010,0030)	2, filled from User Interface	2, From Worklist or User Interface
Patient's sex	(0010,0040)	2, filled from User Interface	2, From Worklist or User Interface
Referenced Patient sequence	(0008,1120)	2, Sent Empty	2, Sent Empty
Issuer of Patient ID	(0010,0021)	3, Not Sent	3, From Worklist.
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3, Not Sent	3, From Worklist.
>Universal Entity ID	(0040, 0032)	3, Not Sent	3, From Worklist.
>Universal Entity ID Type	(0040,0033)	1, Not Sent	1, From Worklist.
>Identifier Type Code	(0040,0035)	3, Not Sent	3, From Worklist.

4.3 Performed Procedure Step Information Module

Table 8-4: Performed Procedure Step Information Module Attributes

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Performed Procedure Step ID	(0040,0253)	1	-	Internally generated. Unique within a patient.
Performed Station AE Title	(0040,0241)	1	-	"TERRA" [AE Title configured in DL]
Performed Station Name	(0040,0242)	2	-	Same as AE Title "TERRA"
Performed Location	(0040,0243)	2	-	EMPTY
Performed Procedure Step Start Date	(0040,0244)	1	-	Date on which the Performed Procedure Step started.
Performed Procedure Step Start Time	(0040,0245)	1	-	Time at which the Performed Procedure Step started.

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Performed Procedure Step Status	(0040,0252)	1	3	Contains the state of the Performed Procedure Step. Enumerated Values: IN PROGRESS = Started but not complete DISCONTINUED = Canceled or unsuccessfully terminated COMPLETED = Successfully completed
Performed Procedure Step Description	(0040,0254)	2	3	Institution-generated description or classification of the Procedure Step that was performed.
Performed Procedure Type Description	(0040,0255)	2	3	A description of the type of procedure performed.
Performed Procedure Code Sequence	(0008,1032)	2	3	For Scheduled cases, copy from Requested Procedure Code Sequence. Sent Empty in case of unscheduled exams.
>Code Value	(0008,0100)	1C	1C	The Code Value (0008,0100) is an identifier that is unambiguous within the Coding Scheme denoted by Coding Scheme Designator (0008,0102) and Coding Scheme Version (0008,0103)
>Coding Scheme Designator	(0008,0102)	1C	1C	The attribute Coding Scheme Designator (0008,0102) identifies the coding scheme in which the code for a term is defined.
>Code Meaning	(0008,0104)	3	3	The Code Meaning (0008,0104) is text which has meaning to a human and which conveys the meaning of the term defined by the combination of Code Value and Coding Scheme Designator.
Performed Procedure Step End Date	(0040,0250)	2	3	Date on which the Performed Procedure Step ended.
Performed Procedure Step End Time	(0040,0251)	2	3	Time at which the Performed Procedure Step ended.
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3	3	The reason the Performed Procedure Step Status (0040,0252) was set to DISCONTINUED.
>Code Value	(0008,0100)	1	1C	The Code Value (0008,0100) is an identifier that is unambiguous within the Coding Scheme denoted by Coding Scheme Designator (0008,0102) and Coding Scheme Version (0008,0103).
>Coding Scheme Designator	(0008,0102)	1	1C	The attribute Coding Scheme Designator (0008,0102) identifies the coding scheme in which the code for a term is defined.
>Code Meaning	(0008,0104)	3	3	The Code Meaning (0008,0104) is text which has meaning to a human and which conveys the meaning of the term defined by the combination of Code Value and Coding Scheme Designator.

4.4 Image Acquisition Result Module

Table 8-5: Image Acquisition Result Module Attributes

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Modality	(0008,0060)	1	-	XA
Study Id	(0020,0010)	2	-	For scheduled case: Study ID (0020,0010) is equal to the Requested Procedure ID (0040,1001) extracted from the Modality Worklist item. For an unscheduled case: Study ID (0020,0010) will be equal to the value entered by the user, in UI.
Performed Protocol Code Sequence	(0040,0260)	2	3	Sequence describing the Protocol performed for this Procedure Step. This sequence may have zero or more Items.
>Code Value	(0008,0100)	1C	1C	The Code Value (0008,0100) is an identifier that is unambiguous within the Coding Scheme denoted by Coding Scheme Designator (0008,0102) and Coding Scheme Version (0008,0103).
>Coding Scheme Designator	(0008,0102)	1C	1C	The attribute Coding Scheme Designator (0008,0102) identifies the coding scheme in which the code for a term is defined.
>Code Meaning	(0008,0104)	3	3	The Code Meaning (0008,0104) is text which has meaning to a human and which conveys the meaning of the term defined by the combination of Code Value and Coding Scheme Designator.
Performed Series Sequence	(0040,0340)	2	3	N-Create - Always sent EMPTY. N-Set - Attributes of the Series that comprise this Modality Performed Procedure Step. The Sequence may have one or more Items.
>Performing Physician's Name	(0008,1050)	-	2C	Name of the physician(s) administering this Series.
>Protocol Name	(0018,1030)	-	1C	User-defined description of the conditions under which the Series was performed.
>Operator’s Name	(0008,1070)	-	2C	Name(s) of the operator(s) who supporting this Series.
>Series Instance UID	(0020,000E)	-	1C	Unique Identifier of the Series.
>Series Description	(0008,103E)	-	2C	User provided description of the Series.
>Retrieve AE Title	(0008,0054)	-	2C	AE Title
>Referenced Image Sequence	(0008,1140)	-	2C	A Sequence that provides reference to XA Image SOP Instances created during the acquisition of the procedure step. This does not include reference of the Secondary Capture Image SOP Instances. The sequence may have zero or more Items.
>>Referenced SOP Class UID	(0008,1150)	-	1C	Uniquely identifies the referenced SOP Class.
>>Referenced SOP Instance UID	(0008,1155)	-	1C	Uniquely identifies the referenced SOP Instance.

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	-	2C	Uniquely identifies Radiation Dose Structured Reports, created during the acquisition of the procedure step, and that are not referenced in Referenced Image Sequence (0008,1140). The sequence may have zero or more Items.
>>Referenced SOP Class UID	(0008,1150)	1C	1C	Uniquely identifies the referenced SOP Class (Dose SR)
>>Referenced SOP Instance UID	(0008,1155)	1C	1C	Uniquely identifies the referenced SOP Instance. (Dose SR)

4.5 Radiation Dose Module

Table 8-6: Radiation Dose Module Attributes

Attribute Name	Tag	Type for SCU N-CREATE	Type for SCU N-SET	Use
Total Time of Fluoroscopy	(0040,0300)	3	3	N-Create - Sent Empty. N-Set - Total duration of X-Ray exposure during fluoroscopy in seconds (pedal time) during this Performed Procedure Step.
Total Number of Exposures	(0040,0301)	3	3	N-Create - Sent Empty. N-Set - Total number of exposures made during this Performed Procedure Step.
Entrance Dose	(0040,0302)	3	3	N-Create - Sent Empty. N-Set - Average entrance dose value measured in dGy at the surface of the patient during this Performed Procedure Step.
Entrance Dose in mGy	(0040,8302)	3	3	N-Create - Sent Empty. N-Set - Average entrance dose value measured in mGy at the surface of the patient during this Performed Procedure Step.
Image Area Dose Product	(0018,115E)	3	3	N-Create - Sent Empty. N-Set - Total area-dose-product to which the patient was exposed, accumulated over the complete Performed Procedure Step and-measured in dGy*cm*cm, including fluoroscopy.

5 Billing and Material Management Codes Module

N/A

6 Standard Extended and Private Data Attributes

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended MPPS Instances as Type 3 data elements.

6.1 Standard Attributes

The Product supports the following attributes, not specified in the MPPS IOD, in SOP Instances as Type 3 data elements.

Table 8-7: Standard Extended Attributes

Attribute Name	Tag	Use
Exposure Dose Sequence	(0040,030E)	Exposure Dose Sequence will contain Total Number of Exposures (0040,0301) items plus an item for each fluoroscopy episode not already counted as an exposure.
>Radiation Mode	(0018,115A)	Specifies X-Ray radiation mode. Enumerated Values: • CONTINUOUS • PULSED
>KVp	(0018,0060)	Peak kilo voltage output of the x-ray generator used. An average in the case of fluoroscopy (continuous radiation mode).
>X-Ray Tube Current in µA	(0018,8151)	X-Ray Tube Current in µA. An average in the case of fluoroscopy (continuous radiation mode).
>Exposure Time	(0018,1150)	Time of x-ray exposure or fluoroscopy in msec.
>Type of Filters	(0018, 1161)	Type of filter(s) inserted into the X-Ray beam (e.g.wedges).
>Filter Material	(0018, 7050)	If filter used, value = "MIXED"

6.2 Private Group GEMS_DL_STUDY_01

Private Group GEMS_DL_STUDY_01 is modeled as part of the Performed Procedure Step Information Entity.

Table 8-8: Private Group GEMS_DL_STUDY_01

Attribute Name	Tag	VR	VM	Attribute Description and Use
pps_dose	(0015,xx80)	DS	1	Total dose delivered to the patient during the Performed Procedure Step(in mGy).
pps_total_dap	(0015,xx81)	DS	1	Cumulative dose area product for the Performed Procedure Step (in cGy.cm2).
pps_fluoro_dap	(0015,xx82)	DS	1	Cumulative dose area product for the fluoro acquisitions performed during the Performed Procedure Step (in cGy.cm2).
pps_fluoro_time	(0015,xx83)	IS	1	Total time of fluoroscopy during the Performed Procedure Step (in seconds).
pps_record_dap	(0015,xx84)	DS	1	Cumulative dose area product for the record acquisitions performed during the Performed Procedure Step (in cGy.cm2).

Attribute Name	Tag	VR	VM	Attribute Description and Use
pps_record_time	(0015,xx85)	IS	1	Total time of record acquisitions during the Performed Procedure Step (in seconds).
number of record runs	(0015,xx9E)	IS	1	Total number of exposures made during the Performed Procedure Step (no units).

6.3 Private Group GEMS_DLX_DOSE_1

Private Group GEMS_DLX_DOSE_1 is modeled as part of the Performed Procedure Step Information Entity.

Table 8-9: Private Group GEMS_DLX_DOSE_1

Attribute Name	Tag	VR	VM	Attribute Description and Use
Dose Cumulation	(0027,xx16)	CS	1	Defined terms: "CUMULATE".
Private Radiation Dose Sequence	(0027,xx01)	SQ	1-n	Private Radiation Dose Sequence.
>Run Number	(0027,xx02)	IS	1	A number that identifies the image [image number].
>Run Time	(0027,xx03)	TM	1	Time the Series started.
>No of frames	(0027,xx04)	IS	1	Number of Frames.
>Frames per sec	(0027,xx05)	DS	1	Number of frames per second.
>Plane	(0027,xx06)	CS	1	Plane on which the current image is acquired. Defined terms: FR for Monoplane.
>KV	(0027,xx07)	DS	1	Peak kilo voltage output of the x-ray generator used [in kv].
>mA	(0027,xx08)	DS	1	X-ray tube current [in mA].
>mAs	(0027,xx09)	DS	1	Exposure conditions (mAs).
>ms	(0027,xx10)	DS	1	Duration of xray exposure [in msec].
>Angulation	(0027,xx11)	DS	1	Position of the Xray Image Intensifier about the patient from the RAO to LAO direction where movement from RAO to vertical is positive [in degrees].
>Rotation	(0027,xx12)	DS	1	Position of the Xray Image Intensifier about the patient from the CAU to CRA direction where movement from CAU to vertical is positive [in degrees].
>Focal Distance	(0027,xx13)	DS	1	Distance [in mm] from source to detector center.
>Field of View	(0027,xx14)	DS	1	Dimensions of the image Intensifier Field of View [in mm].
>Table Vertical Position	(0027,xx15)	DS	1	Absolute Vertical position of the table [in mm] with respect to the table referential. Down moving is positive. The value of this attribute applies to the first frame of the Multi-frame image.

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Chapter 9 X-ray Radiation Dose Structured Report Information Object Implementation

1 Introduction

This section specifies the use of the DICOM X-Ray Radiation Dose SR IOD to represent results produced by this implementation. Corresponding attributes are conveyed using the module construct.

2 Optima Mapping of DICOM Entities

The Optima system maps DICOM Information Entities to local Information Entities in the product's database and user interface.

Table 9-1: Mapping OF DICOM Entities to Optima Entities

DICOM IE	Optima Entity
Patient	Patient
Study	Exam
Series	Exam
Document	

3 IOD Module Table

The X-Ray Radiation Dose Structured Report Information Object Definitions comprise the modules of the following tables.

The contents of the SR Document Content are constrained by the supported template, as identified in Section 4.4.2, SR Document Content Module. Standard, Standard Extended and Private Templates are further described in Standard, Standard Extended and Private Templates.

Table 9-2: Structure Report IOD Modules

Entity Name	Module Name	Usage	Reference
Patient	Patient	Used	Chapter 4, Section 4.1, Table 4-3: Patient Module Attributes
	Specimen Identification	Not Used	N/A
	Clinical Trial Subject	Not Used	N/A
Study	General Study	Used	Section 4.1, Table 9-3: General Study Module Attributes
	Patient Study	Used	Chapter 4, Section 4.2.2, Table 4-5: Patient Study Module Attributes
	Clinical Trial Study	Not Used	N/A
Series	SR Document Series	Used	Section 4.2, Table 9-4: SR Document Series Module Attributes
	Clinical Trial Series	Not Used	N/A
Frame Of Reference	Synchronization	Not Used	N/A
Equipment	General Equipment	Used	Section 4.3, Table 9-5: General Equipment Module Attributes
Document	SR Document General	Used	Section 4.4.1, Table 9-6: SR Document General Module Attributes
	SR Document Content	Used	Section 4.4.2, Table 9-7: SR Document Content Module Attributes
	SOP Common	Used	Section 4.4.3, Table 9-9: SOP Common Module Attributes

4 Information Module Definitions

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the SR Information Objects.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from when generating the instance. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions). Also note that Attributes not present in tables are not supported.

4.1 Study Entity Modules

General Study Module

Table 9-3: General Study Module Attributes

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	From Worklist. Otherwise, Internally generated.
Study Date	(0008,0020)	2	YYYYMMDD, restricted to 8 characters.
Study Time	(0008,0030)	2	HHMMSS.XXX, restricted to 10 characters.
Referring Physician's Name	(0008,0090)	2	From User Interface or worklist, restricted to 64 characters.
Study ID	(0020,0010)	2	From User Interface or Worklist, restricted to 64 characters.
Accession Number	(0008,0050)	2	From User Interface or Worklist, restricted to 16 characters.
Study Description	(0008,1030)	3	Generated description from the worklist entries.If no value found,value is taken from user interface.
Name of Physician(s) Reading Study	(0008,1060)	3	From User Interface, restricted to 64 characters.
Referenced Study Sequence	(0008,1110)	3	From Worklist. The sequence may have zero or more Items.
>Referenced SOP Class UID	(0008,1150)	1	From Worklist. Required if a sequence item is present.
>Referenced SOP instance UID	(0008,1155)	1	From Worklist. Required if a sequence item is present.

4.2 Series Entity Modules

SR Document Series Module

Table 9-4: SR Document Series Module Attributes

Attribute Name	Tag	Type	Attribute Description

Modality	(0008,0060)	1	Value = SR
Series Instance UID	(0020,000E)	1	Unique identifier of the SR Series
Series Number	(0020,0011)	1	Starts from 990
Series Date	(0008,0021)	3	Date the Series started
Series Time	(0008,0031)	3	Time the Series started
Protocol Name	(0018,1030)	3	Decription of the contents under which series was performed
Series Description	(0008,103E)	3	Value = "RADIATION DOSE INFORMATION"
Referenced Performed Procedure Step Sequence	(0008,1111)	2	Identifies the Performed Procedure Step SOP Instance in which the Series is created. Identical to the MPPS of the image Series.
>Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.
>Referenced SOP instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.

4.3 Equipment Entity Modules

General Equipment Module

Table 9-5: General Equipment Module Attributes

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	1	Value = "GE MEDICAL SYSTEMS"
Institution Name	(0008,0080)	3	From "Service User Interface", configured at the installation of the system. Restricted to 64 characters.
Institution Address	(0008,0081)	3	From "Service User Interface", configured at the installation of the system. Restricted to 1024 characters.
Station Name	(0008,1010)	3	AE-title of the system
Manufacturer's Model Name	(0008,1090)	1	Value = “DL”
Device Serial Number	(0018,1000)	1	From internal configuration of the machine.
Software Versions	(0018,1020)	1	DL application version.

4.4 Document Entity Modules

4.4.1 SR Document General Module

Table 9-6: SR Document General Module Attributes

Attribute Name	Tag	Type	Attribute Description

Instance Number	(0020,0013)	1	Value = “1”
Completion Flag	(0040,A491)	1	Value = COMPLETE [Complete content]
Verification Flag	(0040,A493)	1	Value = UNVERIFIED [Not attested to.]
Content Date	(0008,0023)	1	The date the document content creation started.
Content Time	(0008,0033)	1	The time the document content creation started.
Referenced Request Sequence	(0040,A370)	1C	Identifies Requested Procedures which are being fulfilled (completely or partially) by creation of this Document. One or more items may be included
>Study Instance UID	(0020,000D)	1	Restricted to 64 characters, internally generated. Identical to Study Instance UID in General Study Module.
>Referenced Study Sequence	(0008,1110)	2	From Worklist
>>Referenced SOP Class UID	(0008,1150)	1	From Worklist. Required if a sequence item is present.
>>Referenced SOP instance UID	(0008,1155)	1	From Worklist. Required if a sequence item is present.
>Accession Number	(0008,0050)	2	From User Interface or worklist, restricted to 64 characters.
>Placer Order Number	(0040,2016)	2	EMPTY
>Filler Order Number	(0040,2017)	2	EMPTY
>Requested Procedure ID	(0040,1001)	2	From worklist
>Requested Procedure Description	(0032,1060)	2	From worklist
>Requested Procedure Code Sequence	(0032,1064)	2	From worklist
>Code Value	(0008,0100)	1	Required if a sequence item is present
>Code scheme designator	(0008,0102)	1	Required if a sequence item is present
>Code meaning	(0008,0104)	1	Required if a sequence item is present
Performed Procedure Code Sequence	(0040,A372)	2	A sequence that conveys the type of procedure performed.
>Code Value	(0008,0100)	1	Required if a sequence item is present
>Code scheme designator	(0008,0102)	1	Required if a sequence item is present
>Code meaning	(0008,0104)	1	Required if a sequence item is present

Current Requested Procedure Evidence Sequence	(0040,A375)	1C	A sequence that provides references to the list of all the acquired and stored x-ray images and DoseMap photos of the study.
>Study Instance UID	(0020,000D)	1	Required if a sequence item is present
>Referenced Series Sequence	(0008,1115)	1	Required if a sequence item is present
>>Series Instance UID	(0020,000E)	1	Required if a sequence item is present
>>Referenced SOP Sequence	(0008,1199)	1	Required if a sequence item is present
>>>Referenced SOP Class UID	(0008,1150)	1	Required if a sequence item is present
>>>Referenced SOP Instance UID	(0008,1155)	1	Required if a sequence item is present

4.4.2 SR Document Content Module

Table 9-7: SR Document Content Module Attributes

Attribute Name	Tag	Type	Attribute Description
Observation DateTime	(0040,A032)	1C	The date and time on which this Content Item was completed.
Content Template Sequence	(0040,A504)	1C	Template that describes the content of this Content Item and its subsidiary Content Items. Only a single Item shall be permitted in this sequence.
>Mapping Resource	(0008,0105)	1	DCMR
>Template Identifier	(0040,DB00)	1	10001
Value Type	(0040,A040)	1	CONTAINER
Continuity of Content	(0040,A050)	1C	"SEPARATE"
Concept Name Code Sequence	(0040,A043)	1C	
>Code Value	(0008,0100)	1	113701
>code scheme designator	(0008,0102)	1	DCM
>Code meaning	(0008,0104)	1	“X-Ray Radiation Dose Report”
Content Sequence	(0040,A730)	1C	Sequence of Content Items, with possible recursive subsidiary Content Items, encoding the hierarchical tree of SR content.
> Relationship Type	(0040,A010)	1	
> Insert SR DocumentContent Module			Recursive inclusion to create document content tree. See section 1.4.4.2.1 for the list of supported templates

SR Document Content Descriptions

The product supports the following root Templates for SR SOP Instances created by the product.

Table 9-8: SR Root Templates

SOP Class	Template ID	Template Name	Use
X-Ray Radiation Dose SR	10001	X-Ray Radiation Dose	Create

Refer to section Standard, Standard Extended and Private Templates for a detailed description of the supported templates.

4.4.3 SOP Common Module

Table 9-9: SOP Common Module Attributes

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	“1.2.840.10008.5.1.4.1.1.88.67”
SOP Instance UID	(0008,0018)	1	Restricted to 64 characters, internally generated.
Specific Character Set	(0008,0005)	1C	“ISO_IR 100” (Latin Alphabet No. 1)

5 Standard Extended and Private Context Groups

5.1 Standard Extended and Private Context Groups

The Product supports coded terminology using Standard Extended, Private, and Configurable Context Groups defined in the following sections.

5.2 Standard Extended Context Groups

The Product supports the following extensions to standard Context Groups for SR SOP Instances created by this product. Extensions are indicated by bold text.

Table 9-10: Context ID 4031 Common Anatomic Regions

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (-80,104)
SRT	R-41198	Unknown
SRT	T-D1100	Head
SRT	T-D1000	Head and Neck
SRT	T-45010	Carotid Artery
SRT	R-FAB54	Neck, Chest, Abdomen and Pelvis
SRT	T-D3000	Chest
SRT	T-43000	Coronary artery
SRT	T-32600	Left ventricle
SRT	T-32000	Heart
SRT	T-44000	Pulmonary artery
SRT	T-D4000	Abdomen
SRT	T-42000	Aorta
SRT	T-42300	Aortic arch
SRT	T-D6000	Pelvis
SRT	T-47400	Femoral artery
SRT	T-D9400	Leg
SRT	T-D9700	Foot
SRT	T-D0300	Extremity
SRT	T-47500	Popliteal artery
SRT	T-D8700	Hand
SRT	T-D8200	Arm

5.3 Private Context Groups

None

5.4 Configurable Context Groups

None

6 Standard, Standard Extended and Private Templates

The Product supports the Standard Extended and Private Templates defined in the following sections.

6.1 Standard Templates

The Product supports the following standard templates for SOP Instances created by this product.

6.1.1 Template ID 10001 X-Ray Radiation Dose

Table 9-11:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113701, DCM, “X-Ray Radiation Dose Report”)	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (121058, DCM, ”Procedure reported”)	1	M		DT (113704, DCM, “Projection X-Ray”)
3	>>	HAS CONCEPT MOD	CODE	EV (G-C0E8, SRT, “Has Intent”)	1	M		Value = (R-002E9, SRT, "Combined Diagnostic and Therapeutic Procedure")
4	>		INCLUDE	DTID (1002) Observer Context	1-N	M		See **TID 1002 Observer Context (Device Context)**
5	>	HAS OBS CONTEXT	CODE	EV (113705, DCM, “Scope of Accumulation”)	1	M		Value = (113016, DCM, “Performed Procedure Step”)
6	>>	HAS PROPERTIES	UIDREF	(121126, DCM, Performed Procedure Step SOP Instance UID)	1	M		System generated PPS Instance UID
7	>	CONTAINS	INCLUDE	DTID (10002) Accumulated X-Ray Dose	1	MC	IFF Single Plane system	See **TID 10002 Accumulated X-Ray Dose** Where, $Plane = EV (113622, DCM, ”Single Plane”)
8	>	CONTAINS	INCLUDE	DTID (10002) Accumulated X-Ray Dose	1	MC	IFF Biplane system - Frontal Plane	Not Used
9	>	CONTAINS	INCLUDE	DTID (10002) Accumulated X-Ray Dose	1	MC	IFF Biplane system – Lateral Plane	Not Used
10	>	CONTAINS	INCLUDE	DTID (10003) Irradiation Event X-Ray Data	1-N	M		See **TID 10003 Irradiation Event X-Ray Data**
11	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		System generated comments using the PPS ID and Patient ID
12	>	CONTAINS	IMAGE	EV (121342, DCM, Dose Image)	1-N	U		References to the dose map photo generated for that Performed Procedure Step
13	>	CONTAINS	INCLUDE	DTID (1020) Person Participant	1	U		Not Used

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
14	>	CONTAINS	CODE	EV (113854, DCM, “Source of Dose Information”)	1-N	M		Value = (113856, DCM, "Automated Data Collection")

6.1.2 TID 10002 Accumulated X-Ray Dose (Type: Extensible)

Table 9-12:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113702, DCM, ”Accumulated X-Ray Dose Data”)	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (113764, DCM, “Acquisition Plane”)	1	M		$Plane = EV (113622, DCM, ”Single Plane”)
3	>	CONTAINS	CONTAINER	EV (122505, DCM, “Calibration”)	1-N	MC	IFF Calibration Data is available	Sent if mRmAs calibration date and Calibration responsible Party value is available.
4	>>	HAS CONCEPT MOD	CODE	EV (113794, DCM, “Dose Measurement Device”)	1	M		Value = (A-2C090, SRT, “Dosimeter”)
5	>>	CONTAINS	DATETIME	EV (113723, DCM, “Calibration Date”)	1	M		mRmAs Calibration date of that plane
6	>>	CONTAINS	NUM	EV (122322, DCM, “Calibration Factor”)	1	M		Value = "1.0" Units = EV (1, UCUM, “no units”)
7	>>	CONTAINS	NUM	EV (113763, DCM, “Calibration Uncertainty”)	1	M		Value = "35" Units = EV (%, UCUM, “Percent”)
8	>>	CONTAINS	TEXT	EV (113724, DCM, “Calibration Responsible Party”)	1	M		Value = Calibration Responsible Party defined in the system
9	>	CONTAINS	INCLUDE	DTID (10004) Accumulated Projection X-Ray Dose	1	MC	XOR row 11, IFF TID (10001) Row 2 = (113704, DCM, “Projection X-Ray”)	See **TID 10004 Accumulated Projection X-Ray Dose**
10	>	CONTAINS	INCLUDE	DTID (10005) Accumulated Mammography X-Ray Dose	1	MC	XOR row 10, IFF TID (10001) Row 2 = (P5¬40010, SRT, “Mammography”)	Not Used

6.1.3 TID 10003 Irradiation Event X-Ray Data (Type: Extensible)

Table 9-13:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113706, DCM, ”Irradiation Event X-Ray Data”)	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (113764, DCM, “Acquisition Plane”)	1	M		(113622, DCM, ”Single Plane”)
3	>	CONTAINS	DATETIME	DT (111526, DCM, “Date-Time Started”)	1	M		Image acquisition date and time
4	>	CONTAINS	CODE	EV (113721, DCM, “Irradiation Event Type”)	1	M		If (FLUORO) Then Value = (P5-06000, SRT, "fluoroscopy") If (Positioner Motion=Table Motion=STATIC) Then Value = (113611, DCM, "Stationary Acquisition") If Positioner Motion=DYNAMIC and Table Motion=STATIC Then Value = (113613, DCM, "Rotational Acquisition") If Table Motion=DYNAMIC Then Value = (113612, DCM, "Stepping Acquisition")
5	>	CONTAINS	TEXT	EV (125203, DCM, “Acquisition Protocol”)	1	U		concatenation of Protocol name and Acquisition mode
6	>>	CONTAINS	CODE	EV (T-D0005, SRT, “Anatomical structure”)	1	U		Not Used
7	>	HAS CONCEPT MOD	CODE	EV (G-C171, SRT, “Laterality")	1	UC	If anatomy is bi-lateral	Not Used
8	>	CONTAINS	TEXT	EV (113780, DCM, “Reference Point Definition”)	1	MC	IF Row 13 or Row 14 is present and Row 9 is not present	Not Used
9	>	CONTAINS	CODE	EV (113780, DCM, “Reference Point Definition”)	1	U MC	Used	(113860, DCM, “15cm from Isocenter toward Source”)
10	>	CONTAINS	UIDREF	EV (113769, DCM, “Irradiation Event UID”)	1	M		Unique for every irradiation. Restricted to 64 characters, internally generated
11	>	CONTAINS	NUM	EV (122130, DCM, “Dose Area Product”	1	MC	IFF TID (10001) Row 2 = (113704, DCM, “Projection X-Ray”)	Units = EV (Gy.m^2, UCUM, "Gy.m^2")
12	>	CONTAINS	NUM	EV (111631, DCM, “Average Glandular Dose”)	1	MC	IFF TID (10001) Row 2 = (P5-40010, SRT, “Mammography”)	Not Used

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
13	>	CONTAINS	NUM	EV (113738, DCM, “Dose (RP)”)	1	MC	IFF TID (10001) Row 2 = (113704, DCM, “Projection X-Ray”) AND any of the values of TID (10001) Row 14 are not (113858, DCM, “MPPS Content”)	Units = EV (Gy, UCUM, “Gy”)
14	>	CONTAINS	NUM	EV (111636, DCM, “Entrance Exposure at RP”)	1	MC	IFF TID (10001) Row 2 = (P5-40010, SRT, “Mammography”)	Not Used
15	>	CONTAINS	NUM	EV (112011, DCM, “Positioner Primary Angle”)	1	UC	XOR Row 19	Position of the Xray Image Intensifier about the patient from the RAO to LAO direction where movement from RAO to vertical is positive. Units = EV (deg, UCUM, “deg”)
16	>	CONTAINS	NUM	EV (112012, DCM, “Positioner Secondary Angle”)	1	UC	XOR Row 19	Position of the Xray Image Intensifier about the patient from the CAU to CRA direction where movement from CAU to vertical is positive. Units = EV (deg, UCUM, “deg”)
17	>	CONTAINS	NUM	EV (113739, DCM, “Positioner Primary End Angle”	1	UC	IFF Row 4 value = (113613, DCM, “ ”, “Rotational Acquisition”))	Units = EV (deg, UCUM, “deg”)
18	>	CONTAINS	NUM	EV (113740, DCM, “Positioner Secondary End Angle”	1	UC	IFF Row 4 value = (113613, DCM, “Rotational Acquisition”)	Units = EV (deg, UCUM, “deg”)
19	>	CONTAINS	NUM	EV (113770, DCM, “Column Angulation”)	1	UC	XOR Rows 15,16	Not Used
20	>	CONTAINS	NUM	EV (113790, DCM, “Collimated Field Area”	1	U		Minimum area between the FOV area and the collimated area based on collimator coordinates and the pixel size. Units = EV (m2, UCUM, “m^2”)

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
21	>	CONTAINS	CONTAINER	EV (113771, DCM, “X-Ray Filters”)	1-N	U		Type of filter(s) inserted into the X-Ray beam. For cardiac setup, there is maximum of 1 filter. For angio setup, there can be maximum 3 filters.
22	>>	CONTAINS	CODE	EV (113772, DCM, “X-Ray Filter Type”)	1	U		(113651, DCM, "Wedge filter")
23	>>	CONTAINS	CODE	EV (113757, DCM, “X-Ray Filter Material”)	1	U		(C-127F9, SRT, "Copper or Copper compound")
24	>>	CONTAINS	NUM	EV (113758, DCM, “X-Ray Filter Thickness Minimum”)	1	U		Units = EV (mm, UCUM, “mm”)
25	>>	CONTAINS	NUM	EV (113773, DCM, “X-Ray Filter Thickness Maximum”)	1	U		Units = EV (mm, UCUM, “mm”) Value = “2”
26	>	CONTAINS	CODE	EV (113732, DCM, “Fluoro Mode”)	1	UC	Used	(113631, DCM, "Pulsed")
27	>	CONTAINS	NUM	EV (113791, DCM, “Pulse Rate”)	1	MC	Used	Units = EV ({pulse}/s, UCUM, “pulse/s”)
28	>	CONTAINS	NUM	EV (113768, DCM, “Number of Pulses”)	1	MC	Used	Units = EV (1, UCUM, “no units”)
29	>>	HAS CONCEPT MOD	CODE	EV (121401, DCM, “Derivation”)	1	MC	IFF count of pulses in Row 28 is estimated	Not Used
30	>	CONTAINS	NUM	EV (113733, DCM, “KVP”)	1-N	U		Contains only one item. Units = EV (kV, UCUM, “kV”)
31	>	CONTAINS	NUM	EV (113734, DCM, “X-Ray Tube Current”)	1-N	U		Contains only one item. Units = EV (mA, UCUM, “mA”)
32	>	CONTAINS	NUM	EV (113735, DCM, “Exposure Time”)	1	U		Units = EV (ms, UCUM, “ms”)
33	>	CONTAINS	NUM	EV (113793, DCM, “Pulse Width”)	1-N	U		Contains only one item. Units = EV (ms, UCUM, “ms”)
34	>	CONTAINS	NUM	EV (113824, DCM, “Exposure”)	1-N	U		Contains only one item. Units = EV (uAs, UCUM, “uAs”)
35	>	CONTAINS	NUM	EV (113766, DCM, “Focal Spot Size”)	1	U		Units = EV (mm, UCUM, “mm”)
36	>	CONTAINS	NUM	EV (113742, DCM, “Irradiation Duration”)	1	U		Units = EV (s, UCUM, “s”)
37	>	CONTAINS	NUM	EV (113767, DCM, “Average X-Ray Tube Current”)	1	U		Units = EV (mA, UCUM, “mA”)

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
38	>	CONTAINS	CODE	EV (113745, DCM, “Patient Table Relationship”)	1	U		If "Patient Position" = HFS (or) HFP(or) HFDL(or) HFDR Value = (F-10470, SRT, “headfirst”) If "Patient Position" = FFS (or) FFP(or) FFDR(or) FFDL Value = (F-10480, SRT, “feet-first”)
39	>	CONTAINS	CODE	EV (113743, DCM, “Patient Orientation”)	1	U		Value = (F-10450, SRT, “recumbent”
40	>>	HAS CONCEPT MOD	CODE	EV (113744, DCM, “Patient Orientation Modifier”)	1	M		If “Patient Position” = HFP or FFP value = (F-10310, SRT, Prone) If “Patient Position” = HFS or FFS value = (F-10340, SRT, Supine) If “Patient Position” = HFDR or FFDR value = (F-10317, SRT, Right lateral ducubitus) If “Patient Position” = HFDL or FFDL value = (F-10319, SRT, left lateral decubitus)
41	>	CONTAINS	NUM	DCID (10008) Dose Related Distance Measurements	1-N	U		Units = EV (mm, UCUM, “mm”) Includes the following measurements: (DCM, 113748, Distance Source to Isocenter) (DCM, 113737, Distance Source to Reference Point) (DCM,113750, Distance Source to Detector) (DCM, 113751, Table Longitudinal Position) - Absolute Longitudinal position of the table (in mm) with respect to the table referential. Head moving is positive. (DCM, 113752, Table Lateral Position) -Absolute Lateral position (in mm) of the table with respect to the table referential. Left moving is positive. (DCM, 113753, Table Height Position) -Absolute Vertical position of the table (in mm) with respect to the table referential. Down moving is positive.

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
42	>	CONTAINS	NUM	EV (113754, DCM, “Table Head Tilt Angle”)	1	U		Angle of the head-feet axis of the table in degrees relative to the horizontal plane. Zero is defined when the head-feet axis is in the horizontal plane. Positive values are when the head of the table is upwards the horizontal plane. Units = EV (deg, UCUM, “deg”)
43	>	CONTAINS	NUM	EV (113755, DCM, “Table Horizontal Rotation Angle”)	1	U		Rotation of the table in the horizontal plane, in degrees. Zero is defined when the head-feet axis of the table is aligned with the CRA-CAU axis of the Isocenter (Z). Positive angles are clockwise when looking at the table from upwards. Units = EV (deg, UCUM, “deg”)
44	>	CONTAINS	NUM	EV (113756, DCM, “Table Cradle Tilt Angle”)	1	U		Units = EV (deg, UCUM, “deg”)
45	>	CONTAINS	CODE	EV (123014 , DCM, (”Target Region”)	1	M		See DCID (4031)
46	>	CONTAINS	CODE	EV (111632, DCM, “Anode Target Material”)	1	U		(C-164F9, SRT, "Tungsten or Tungsten compound")
47	>	CONTAINS	NUM	EV (111633, DCM, “Compression Thickness”)	1	U		Not Used
48	>	CONTAINS	NUM	EV (111634, DCM, “Half Value Layer”)	1	U		Not Used
49	>	CONTAINS	CODE	EV (111635,DCM, “X-Ray Grid”)	1-N	U		Contains 0 to 2 items. If No grid applied, Value = ("111646", DCM, "No grid") If Grid is applied, Value = ("111641", DCM, "Fixed grid") and ("111642", DCM, "Focused grid")
50	>	CONTAINS	INCLUDE	DTID (4007) Mammography CAD Breast Composition	1	U		Not Used
51	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		Image comments
52	>	CONTAINS	INCLUDE	DTID (1020) Person Participant	1-N	U		$PersonProcedureRole = EV (113851, DCM, “Irradiation Administering”). See TID 1020.
53	>	CONTAINS	INCLUDE	DTID (1021) Device Participant	1	M		$DeviceProcedureRole = EV (113859, DCM, “Irradiating Device”). See **TID 1021**.
54	>	CONTAINS	IMAGE	EV (113795, DCM, “Acquired Image”)	1-N	MC		References to Image SOP Class, SOP Instance pairs.

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
55	>	CONTAINS	TEXT	EV (INNOVA-101, 99GEMS, “Dose Reduction Strategy”)	1	UC	IFF Row 4 value = (P5-06000, SRT, "fluoroscopy"))	Specifies the Dose Reduction Strategy that allows selecting between two strategies for reducing dose when lowering fluoro frame rates.
56	>	CONTAINS	TEXT	EV(INNOVA-102, 99GEMS, "Auto Exposure Preference")	1	U		Specifies the autoexposure preference that allows selecting between several strategies impacting Dose and Image Quality.
57	>	CONTAINS	TEXT	EV(INNOVA-103, 99GEMS, "Detail Level")	1	U		Specifies the detail level which includes two settings: Low and Normal. There is about 50% less Air Kerma rate in Low versus Normal, except at max Fluoro dose limits.
58	>	CONTAINS	NUM	EV(INNOVA-104, 99GEMS, "Field Of View Row Dimension")	1	U		Specifies the row dimension of the detector Field of View in mm. Units = EV (mm, UCUM, “mm”)
59	>	CONTAINS	NUM	EV(INNOVA-105, 99GEMS, "Field Of View Column Dimension")	1	U		Specifies the column dimension of the detector Field of View in mm. Units = EV (mm, UCUM, “mm”)
60	>	CONTAINS	NUM	EV(INNOVA-106, 99GEMS, " Patient Equivalent Thickness")	1-N	U		Specifies the equivalent patient thickness in cm. If it contains only one value, it corresponds to the last pulse of the Irradiation Event. If it contains more than one, it shall contain as many values as pulses in the Irradiation Event. Units = EV (cm, UCUM, “cm”)

6.1.4 TID 10004 Accumulated Projection X-Ray Dose (Type: Extensible)

Table 9-14:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	EV (113722, DCM, “Dose Area Product Total”)	1	M		Units = EV (Gy.m^2, UCUM, “Gy.m^2”)
2			NUM	EV (113725, DCM, “Dose (RP) Total”)	1	MC	Used	Units = EV (Gy, UCUM, “Gy”)
3			NUM	EV (113726, DCM, “Fluoro Dose Area Product Total”)	1	MC	Used (If Fluoro is acquired)	Units = EV (Gy.m^2, UCUM, “Gy.m^2”)

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
4			NUM	EV (113728, DCM, “Fluoro Dose (RP) Total”)	1	MC	Used (If Fluoro is acquired)	Units = EV (Gy, UCUM, “Gy”)
5			NUM	EV (113730, DCM, “Total Fluoro Time”)	1	MC	Used(If Fluoro is acquired)	Units = EV (s, UCUM, “s”)
6			NUM	EV (113727, DCM, “Acquisition Dose Area Product Total”)	1	M		Units = EV (Gy.m^2, UCUM, “Gy.m^2”)
7			NUM	EV (113729, DCM, “Acquisition Dose (RP) Total”)	1	MC	Used	Units = EV (Gy, UCUM, “Gy”)
8			NUM	EV (113855, DCM, “Total Acquisition Time”)	1	M		Units = EV (s, UCUM, “s”)
9			NUM	EV (113731, DCM, “Total Number Radiographic Frames”)	1	U	Used	Units = EV (1, UCUM, “no units”) Include only the number of frames of high dose acquisitions (do not include Fluoros)
10			CODE	EV (113780, DCM, “Reference Point Definition”)	1	MC	Used	(113860, DCM, “15cm from Isocenter toward Source”)
11			TEXT	EV (113780, DCM, “Reference Point Definition”)	1	MC	IF Row 2, Row 4 or Row 7 is present and Row 10 is not present.	Not Used

6.1.5 TID 1002 Observer Context

Table 9-15:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (121005,DCM, “Observer Type”)	1	MC	Used	(121007, DCM, "Device")
2		HAS OBS CONTEXT	INCLUDE	DTID (1003) Person observer identifying attributes	1	MC	IFF Row 1 value = (121006,DCM, “Person”) or Row 1 is absent	Not Used
3		HAS OBS CONTEXT	INCLUDE	DTID (1004) Device observer identifying attributes	1	MC		See **TID 1004**

6.1.6 TID 1004 Device Observer Identifying Attributes

Table 9-16:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
			UIDREF	EV (121012,DCM, “Device Observer UID”)	1	M		Defaults to Implementation UID
			TEXT	EV (121013,DCM, “Device Observer Name”)	1	U		Defaults to value of Station Name (0008,1010) in General Equipment Module
			TEXT	EV (121014,DCM, “Device Observer Manufacturer”)	1	U		Defaults to value of Manufacturer (0008,0070) in General Equipment Module
			TEXT	EV (121015,DCM, “Device Observer Model Name”)	1	U		Defaults to value of Manufacturer’s Model Name (0008,1090) in General Equipment Module
			TEXT	EV (121016,DCM, “Device Observer Serial Number”)	1	U		Defaults to value of Device Serial Number (0018,1000) in General Equipment Module
			TEXT	EV (121017,DCM, “Device Observer Physical Location during observation”)	1	U		Not Used

6.1.7 TID 1020 Person Participant

Table 9-17:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			PNAME	EV (113870,DCM, “Person Name”)	1	M		Defaults to Performing Physician Name of the procedure
2	>	HAS PROPERTIES	CODE	EV (113875,DCM, “Person Role in Procedure”)	1	M		(113851, DCM, "Irradiation Administering")
3	>	HAS PROPERTIES	TEXT	EV (113871,DCM, ”Person ID”)	1	U		Not Used
4	>	HAS PROPERTIES	TEXT	EV (113872,DCM, ”Person ID Issuer”)	1	U		Not Used
5	>	HAS PROPERTIES	TEXT	EV (113873,DCM, “Organization Name”)	1	U		Not Used
6	>	HAS PROPERTIES	CODE	EV (113874,DCM, “Person Role in Organization”)	1	U		Not Used

6.1.8 TID 1021 Device Participant

Table 9-18:

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (113876, DCM, “Device Role in Procedure”)	1	M		(113859, DCM, "Irradiating Device")
2	>	HAS PROPERTIES	TEXT	EV (113877, DCM, “Device Name”)	1	U		Defaults to value of Station Name (0008,1010) in General Equipment Module
3	>	HAS PROPERTIES	TEXT	EV (113878, DCM, “Device Manufacturer”)	1	M		Defaults to value of Manufacturer (0008,0070) in General Equipment Module
4	>	HAS PROPERTIES	TEXT	EV (113879, DCM, “Device Model Name”)	1	M		Defaults to value of Manufacturer’s Model Name (0008,1090) in General Equipment Module
5	>	HAS PROPERTIES	TEXT	EV (113880, DCM, “Device Serial Number”)	1	M		Defaults to value of Device Serial Number (0018,1000) in General Equipment Module

6.2 Private Templates

None

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